CLINICAL SURGERY

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CLINICAL SURGERY

FOR THE

INSTRUCTION OF PRACTITIONERS AND STUDENTS
OF SURGERY

BY

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PREFACE.

Many practitioners who have honored the author by visiting his clinic have requested that a work on Clinical Surgery be written by him, giving as nearly as possible the methods adopted in actual practice. This request has been met by the statement that the author lays no claim to the invention of a single new operation, nor has he produced a new or modified instrument, but has contented himself with applying to his surgical work what seemed best in the practice of the surgeons of the past and present, many times without knowing by whom the various methods were modified before they were accepted and used by him.

This book is therefore offered for what it is worth under the limitations mentioned, the author being conscious of a certain incompleteness because of adhering closely to the intention of producing a work reflecting almost entirely the methods which have been thoroughly tried in his own practice.

In recommending certain steps the author does not desire to impress the fact that the method chosen or advised is the best, or the only good one, but rather that it stands as a means he has thoroughly tried and which can be reasonably relied upon. Whenever there is any doubt upon this point it is expressly so stated in the text.

There are necessarily some branches of clinical surgery in which the author's experience is limited, and it has seemed best to indicate this in the text in discussing the special subjects thus impaired.

Certain operations can obviously have no place in this volume, because they have been described in a given way by many writers for years, and would simply consume space for reiteration without increasing the value of the work. I refer especially to the typical ligations, amputations and the resections of joints.

A portion of this work deals with clinical cases taken from hospital records and discussed as one discusses such cases in practice. This has been done for the purpose of bringing the actual clinical conditions before the mind of the reader. It did not seem wise to carry this plan through the subjects in which it was possible to bring out the salient points in more concentrated manner. In order to impress the reader with the cardinal facts upon which success in the treatment of various conditions depends, many unimportant and useless matters have been intentionally omitted. This undoubtedly reduces the scientific merit of the book, but it has appeared to the author to increase its practical value.

No reference is made to authors whose methods are described, because most of the procedures set forth were not used in their original form, having been repeatedly modified, usually by a number of operators. In order to give each one the due amount of credit deserved the work would have grown far beyond the designed limits. An exception is made in those cases in which the original drawings of writers are employed. The author is indebted to all of his friends in the surgical profession whose methods he has adopted, and hopes that where they find familiar details they will appreciate the gratitude he bears toward them for having markedly assisted in the improvement of his technique.

All the drawings herein are original, having been made by Miss Alice L. Cleaveland for this volume from immediate operations, with the exception of a few which were taken from original publications of other authors; the latter are especially designated in their accompanying text.

The author is particularly indebted to his friend, Dr. W. J. Mayo, for many valuable suggestions, and to his brother, Dr. E. H. Ochsner, and his chief assistant, Dr. Nelson M. Percy, for relieving him of many burdens incident to the production of a book.

Finally, it should be said that this work is not written for the great surgeon, or the teacher of surgery, whose methods are as well tried as those contained in this volume, and undoubtedly quite as useful, but rather for the man who is compelled, by virtue of the circumstances surrounding him, to do surgery, and who wishes to know what the author would do in a similar case to the one he happens to have under treatment at any given time. He may be familiar with many methods, but at the same time may wish to know which one has seemed most satisfactory to the author.

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General Surgical Considerations.

THE PATIENT.

The benefits of clinical surgery cannot be realized to the fullest extent without considering the patient himself, aside from the disease for the cure of which he seeks surgical treatment.

Much of the surgeon's success depends upon the value of his judgment and knowledge outside of his especial line of work.

Many patients may live in relative comfort for a considerable period of time whose lives may be cut short by an attempt to obtain complete relief. On the other hand, many patients may, with the same degree of safety, obtain complete relief, rather than partial, as a result of the excellence of the surgeon's judgment.

To excell to the fullest extent, the surgeon requires not only the necessary knowledge to make the proper diagnosis, and technical skill to perform the necessary operation, but he must also have an extensive clinical experience, which can fortunately be obtained, in this country at least, in service as assistant to those who possess this experience, particularly in the great number of excellent hospitals which have been established in most of the larger cities.

In order to be able to judge of the patient's condition, aside from the particular ailment from which he is suffering, it is necessary in each case to make a careful general examination of the patient. This should include a physical examination of the chest, the abdomen, the nervous system, the urine, and at least an observation of the character of the fæces. In many cases the blood should be examined. If there is cough the sputum should be examined microscopically.

In making an examination we should, however, be exceedingly careful not to fall into the opposite error of making a diagnosis without regard to the patient. I have repeatedly seen patients lose their lives because of the fact that the surgeon felt it his duty to make a positive diagnosis. This is especially true of cases in which portions of safely removable tumors were excised, previous to their total removal, for microscopic examination for the purpose of making a positive diagnosis. In these cases I have frequently seen metastases appear very soon after this apparently unimportant preliminary diagnostic operation was performed, which were probably due to the excision of the small portion. I believe this should be very strongly condemned, because the removal of a benign tumor is occasionally a harmless performance compared with the dissemination of a malignant growth. There are but few exceptions to this rule, chiefly in case of bone tumors in which the treatment of a malignant tumor would necessitate an amputation, while a benign tumor can safely be removed from the implicated bone.

In connection with the diagnosis of malignant tumors I would also caution, very emphatically, against applying much pressure to the surfaces of these growths. I have observed many cases of carcinoma of the breast, for instance, which had remained almost stationary for many months until the patient began to have it examined. Each successive examining physician and all the patient's friends had thoroughly massaged the growth during repeated examinations and it seems reasonable to suppose that in this way the rapid increase in growth, the involvement of the lymphatic glands, and possibly the metastasis in the liver could be explained, because of the likelihood of forcing cells from the primary growth into the lymph channels.

In the same manner, I have observed that patients suffering from septic infections of the extremities regularly show a rise in temperature after a thorough examination, during which every effort was made to locate points of fluctuation.

It seems reasonable, therefore, to condemn what might be called diagnostic massage, at least in all cases suffering from malignant growths and from septic infections.

The exploring syringe is an instrument which is also responsible for much harm, because in many cases in which pus has been diagnosed positively without this instrument, the syringe, instead of confirming the diagnosis, shows negative results, on account of some obstruction in the lumen of the exploring cannula used.

In a number of instances I have seen great accumulations of pus removed from empyemata and other abscesses after repeated tests with the exploring syringe had resulted negatively. This is frequently the case, even when a needle with large caliber is used. Many an abscess has remained unopened because the exploring needle was supposed to afford a positive test.

In other cases extensive and serious infections have been caused by the use of the exploring syringe because the great pressure under which the pus was confined in the abscess has forced it into the surrounding tissues or cavities along the puncture made by the exploring needle.

In exploring the brain for the location of an abscess it is sometimes necessary to use an exploring syringe with a large cannula—it may also be useful in differentiating between pleurisy with effusion and empyema—but aside from this I believe that its use should be discarded.

All that has been said against the use of the exploring syringe can be said with much greater emphasis against an instrument which has fortunately been almost entirely discarded, namely, the grooved exploring needle. This instrument possesses all of the bad qualities of the exploring syringe to an exaggerated extent, without having any of its good qualities.

In considering the patient in relation to the advisability of an operation, it will be found that in a large majority of cases there is scarcely any doubt regarding his ability to bear the operation itself, barring accidents; but this fact should not lead us to take for granted that this will be the case in any individual case without having taken pains to make sure. With experience one learns to place certain cases in the class of good risks and others in the class of bad risks, with many intermediate forms; and it is not an easy matter to classify these cases so that one who has not actually come in contact with them can appreciate their difference even with a very minute description.

I would class among the good risks patients who are nearly normal as regards all the organs of the body, with the exception of the part involved in the disease for which the operation is to be performed, if the disease is not located within or near an important organ, and provided that the operation is not to be performed for the relief of a disease due to an acute infection. If the operation is to be performed for the relief of an acute infection, then the risk will depend upon the question,—Can the progress of this infection surely be prohibited by the operation?

It seems that an acute infection does not respect natural strength or endurance. We have here, however, quite a safe guide in the condition of the pulse. An operation performed upon a patient with a pulse of over 120 beats per minute must always be looked upon as serious, and with a pulse still higher the gravity of the condition increases rapidly.

If the operation will remove the existing septic material, and at the same time make a further infection impossible, or at least unlikely, then it must be looked upon as being relatively safe.

Old Age.—Among the conditions almost always enumerated as contra-indicating serious operations is old age. There are certain very good reasons for this. A person who has lived many years has had relatively more opportunity to impair his various organs than one who has lived a shorter time. Moreover, his tissues are in themselves old, and especially his blood vessels have lost much of their elasticity. On the other hand, we must bear in mind that the fact of these persons have attained great age would indicate that they were primarily well made or that their normal resources have been well preserved.

As a matter of experience, I would state that in the absence of obesity, arterio-sclerosis, nephritis, marked anæmia, or cachexia, due to the presence of malignant growths, patients advanced in years bear surgical operations well, if they are permitted to move about and sit up soon after the operation. (This allowance rarely interferes with the recovery after any operation, provided we bear this in mind in the suturing of the wound and in applying the dressings.)

To one whose attention had not been directed to this peculiarity of patients advanced in years it might seem foolhardy to permit the patient to sit up on the day following so serious an operation as amputation of the breast with removal of the pectoralis major and minor muscles and the axillary fat and lymph glands, but experience leads me to say that in operations as severe even as this one, it is strongly to be advised.

INFANCY.—The same seems to be true of the other extreme in age. Infants bear operations well, provided they are not too long continued, nor accompanied by too great loss of blood.

LOSS OF BLOOD.—For all patients it is wise to guard against the loss of an unnecessary amount of blood; but this is especially true in those advanced in years, because many of these do not recover readily from an anæmia caused by a great exsanguination.

OBESITY.—Patients who are very obese, especially those beyond middle age, require particular consideration. Their resistance is diminished; they recover from shock less speedily; they frequently take the anæsthetic badly, and they are more liable to pneumonia following the use of ether than patients with a normal amount of fat. Still it is only seldom that the presence of obesity will contra-indicate an operation entirely. Ordinarily it would simply indicate the use of especial care.

TUBERCULOSIS.—In patients suffering from tuberculosis an operation is usually borne well if it removes the tubercular tissue. If this is not removed by the operation such patients frequently do not do well, consequently the presence of tuberculosis is only a contra-indication to operation in a limited variety of cases.

CACHEXIA DUE TO MALIGNANT GROWTHS.—Ordinarily the presence of cachexia in patients suffering from malignant growths is a distinct contra-indication to operation because these patients do not bear operations well and with few exceptions derive very little benefit. This is, however, not the case in ulcerating carcinoma in which the cachexia is due largely to the absorption of products of decomposition, which can often be safely eliminated by an operation.

Again, in cases in which the malignant growth interferes with nutrition by obstructing some portion of the alimentary canal this rule does not always hold good, because frequently the improved nutrition greatly over-balances the traumatism resulting from the operation.

TIME.—The question of time is of sufficient importance to demand some consideration. It is only necessary to look upon an operation from the two sides which have a bearing in order to come to a proper estimation of the importance of this element: 1, from the merely mechanical or technical point of view, and, 2, from the point of applying this to the patient.

From the technical standpoint it is plain that a skilled mechanic not only does his work well, but accomplishes it in a relatively shorter time, while an unskilled mechanic will have much less satisfactory results by taking a much longer time; skill, accuracy and facility naturally going hand in hand in bringing about the highest possible result.

However, a hasty mechanic may complete a badly-constructed product in a relatively short time; and it is consequently necessary, from a purely technical standpoint, to distinguish clearly between speed which is the result of skill and dexterity, and speed resulting from carelessness, haste and lack of thoroughness. From a purely technical standpoint, then, we have a right to demand the greatest speed compatible with careful, thorough work. When we come to apply this directly to the patient still further elements will be introduced.

Hasty and careless work is more harmful because of the needless traumatism which it is likely to produce, and this may in turn result in shock or in the injury of structures needlessly implicated. The patient may not receive the full amount of benefit through lack of thoroughness, some conditions being overlooked and neglected on account of haste.

On the other hand, it is almost equally bad to prolong an operation unnecessarily, because this exposes the patient to a number of unnecessary dangers: 1, A prolonged anæsthesia increases the danger immediately, and many times patients will recover from a short anæsthesia with scarcely any discomfort, while they will suffer greatly from nausea and vomiting after a prolonged anæsthesia. If ether is employed, a prolonged anæsthesia is much more likely to be followed by bronchitis or pneumonia than a short one. 2, Other things being equal, the amount of shock is proportionate to the relative time consumed in the operation. 3, Infection is more likely to occur in a wound which has been exposed to manipulations for a long time.

Of course, there are many cases in which the element of time is of no real importance because they are so simple, and some patients are so vigorous that they will recover even if they are not given the best possible conditions. It seems, however, reasonable to demand of the surgeon a fair amount of technical skill and dexterity, especially as there are cases in which the lack of this might cause the death of the patient. It seems foolish to hurry and equally so to prolong an operation unnecessarily.

There are two tendencies which become quite prominent in some hospitals and clinics which I believe should be abandoned, one of these might be characterized as insane haste in performing operations and the other as imbecile deliberation. It is difficult to say which of these is the more reprehensible.

Of course, it is not possible for all surgeons to work at a given speed, but every surgeon should strive to waste no time and without hurry to complete each operation in the shortest time compatible with thoroughness. Both careless handling of tissues in order to gain speed and useless manipulation while wasting time should be avoided.

Traumatism.—There can be no doubt of the importance to the patient of reducing the traumatism incident to surgical operations to a minimum. Even though the patient be asleep, and consequently not conscious of the traumatism, the amount of injury done to his tissues is a definite burden placed upon him, and the less this burden is the better for the patient. In order to obtain this minimum of traumatism the conditions in each case must be studied separately and the operation planned accordingly. It is often possible to accomplish the same result through a small as through a large incision, which will reduce the amount of traumatism; in other cases it would require much crushing of the tissues in a small wound while the same operation could be accomplished through a large wound without this added injury.

Above all things a surgeon should form the habit never to manipulate tissues needlessly and especially not to manipulate organs which are not involved and which might readily be left untouched.

In many instances much traumatism is caused by the surgeon for the purpose of securing an absolute repair of a given lesion, which if left to itself would heal spontaneously with a better result and at less expense to the powers of the patient. This is true especially of the newer operations, which are usually quite complicated. One by one the useless elements of the operation are eliminated, and with this progress much of the traumatism is discarded.

HÆMORRHAGE.—Except in especially anæmic patients a moderate amount of blood can be lost during an operation without causing appreciable harm, but it is well to limit the amount by quickly applying hæmostatic forceps to all bleeding points the moment the incision is made, and to grasp the larger vessels, whenever possible, between two pairs of forceps before they are severed; in all operations upon the extremities to elevate the latter for several minutes and then to constrict them above the area of operation with a large rubber tube or a broad rubber band drawn about the extremity a number of times and tied.

It is usually not difficult to reduce the loss of blood to a very small amount without consuming a great deal of time. If strong hæmostatic forceps are used the ends of the blood vessels will be crushed sufficiently to make a ligation of all the smaller vessels unnecessary. It is well to leave the forceps in place until the operation has been completed, then to ligate the larger vessels and simply to remove the forceps from the smaller ones.

TEMPERATURE OF OPERATING ROOM.—The atmosphere in the operating room should be between 68 and 72 degrees F., because such a temperature is about the average for dwellings in this country and the air heated to this point is comfortable both to the patient and the operator. If it is lower it is likely to be cooler than the patient is accustomed to breathe, if warmer, it is likely to be oppressive to the operator and he can scarcely be expected to do his best work when he is partially smothered by hot air. The patient's body should be protected, except at the field of operation, and this need not be so large as to chill the patient. It is well to place hot water-bags about a patient on the operating table if the operation is likely to be of long duration.

It was thought at one time that shock was caused in abdominal operations by the exposure of the intestines to a temperature so much below that of the body, but this objection is no longer tenable, because no abdominal operator exposes the intestines to the atmosphere. The shock referred to above was undoubtedly due to the extensive manipulations of intra-abdominal organs practiced at that time.

If all of these conditions are properly considered as a matter of habit in connection with surgical work it will be found that the post-operative disturbances, especially those due to shock, will be very greatly decreased.

There is a decided difference in the amount of shock from which patients suffer after similar operations performed by different surgeons, and I believe that this difference is due largely to the fact that some surgeons habitually apply all of the principles involved in the above considerations which bear upon limitation of shock while others as habitually disregard them.

Preparation of the Patient for Operation.—The first step in the preparation of the patient after entering the hospital, or after an operation has been decided upon, is to once more make a thorough examination of the patient either in person, or, better still, by an equally competent associate. This examination should be made independently by the associate and then the results should be compared. It should be made in a systematic way and, in hospital practice, at a stated period, so that enough time will be allotted to make it thorough. It is extremely easy to form careless routine habits unless one constantly follows a definite scientific plan. It does not matter especially what plan is followed so long as it is comprehensive. In practice I have found the following scheme to be most satisfactory:

1. Family History.
2. Personal History.
    (a) Previous illness, etc.
    (b) Present illness.
3. Present Condition.
    (a) General condition, development, nutrition, weight.
    (b) Condition of skin.
        1. Complexion.
            I. Anæmia.

- II. Hyperæmia.
- III. Cyanosis.
- IV. Icterus.
- V. Pigmentation.

2. Degree of moisture.
3. Degree of surface heat. Local or general.
4. Œdema.
5. Emphysema.
6. Subcutaneous hæmorrhage.
7. Collateral circulation.
8. Trophic disturbances.

(c) Examination of chest.
  1. Shape. General type.
  2. Frequency and rhythm of respiratory movements.
  3. Excursion.
    - (a) Degree.
    - (b) Symmetry.
  4. Palpation, percussion and auscultation of chest in order to determine condition of heart and lungs.

(d) Examination of pulse as to frequency, rhythm, strength, compressibility and condition of arterial walls.
(e) Inspection, palpation and percussion of abdomen.
(f) Examination of urine, chemical and microscopical.
(g) Temperature.

IN SPECIAL CASES.

A. Examination of Eye. External and Ophthalmoscopic.
B. Examination of Mouth, Pharynx and Œsophagus.
C. Examination of Larynx, Laryngoscopic and Functional.
D. Examination of Nose.
E. Examination of Stomach. Size, Position, Functional Activity. Chemical examination of stomach contents.
F. Examination of Fæces.
G. Examination of Blood.
H. Examination of Nervous System.

I. Examination per rectum, per vagina.
J. Exhaustive Examination of the Diseased Part or Location.

It is true that this plan increases the amount of labor materially and that it is only very seldom that any new facts are determined by the second examination, but it is just in the few cases that it proves to be of the greatest importance.

Another element of considerable value might be mentioned. If the surgeon knows that all of his cases are to be examined thoroughly by an equally competent colleague or assistant he is not so prone to become careless in his personal examinations as his work accumulates.

In this systematic examination many things are considered which may not have any bearing upon any given case in question, but when applied to all the cases in practice each point is of considerable importance.

Of course, the systematic analysis of cases must not be supposed to render superfluous the judgment and practical experience of the surgeon or physician who makes the examination. A thorough system, good judgment, and a wide experience will go together and connectedly in the accomplishment of benefit to the patient.

After all of the conditions present in the case have been determined the necessary preparations for the operation may proceed.

If there exists serious disease of one of the important organs, aside from the condition to be relieved by the operation, *i. e.*, if the heart, lungs, kidneys or the blood be seriously impaired, it is well to overcome this fault unless it is directly the result of a condition which is to be relieved by the operation itself and will probably improve much more rapidly after than before the operation. If no important organ is seriously impaired it is much better not to worry the patient unnecessarily before the operation. As a rule, long-continued preparatory treatment leaves the patient in a much less favorable condition for a surgical procedure than a very short and simple preparation which serves to put the kidneys, the skin and the alimentary canal in condition favorable to the elimination of the waste products.

During the day before the operation the patient should be kept on light diet, consisting of sterilized food, and allowed an abundance of good water, preferably hot, in order to favor elimination through the kidneys, and a non-irritating cathartic given and, if possible, a warm bath. For several years I have given, as a rule, two ounces of castor oil in the foam of beer or malt extract the day before an operation, and a large soap and water enema on the morning of the operation. In this manner the patient is relieved in a relatively short time of much waste matter and is measurably removed from the likelihood of absorbing the products of decomposition which may be present in the alimentary tract. I have found that so large a dose of castor oil is borne perfectly by almost all patients, and that it does not give rise to disturbance, pain or exhaustion. I have also found that the foam of beer or malt extract disguises the oil so thoroughly that patients who are ordinarily nauseated very readily will bear this without annoyance.

In the vast majority of patients this amount of preparation suffices to relieve the body of any burden it may possess which might interfere with the progress of healing. In other words, the patient approaches the operation in a comparatively clean condition; his strength has not been impaired by confinement and his nervous system has not suffered by looking forward to the operation for a long time. Some years ago I had the opportunity to observe the effect of waiting for a number of days, and sometimes for several weeks, to allow the patient to get into a more favorable condition for operation, and I am positive that as a rule the practice is bad. The exceptions are in those patients in whom the heart, the kidneys or the blood are too seriously impaired, and who might be placed in a better condition by waiting; and in cases in which infection is present which may become circumscribed or may be eliminated.

I will refer to these conditions again in connection with patients in whom they are present; and I will especially refer again to old age, because elderly patients bear many operations remarkably well if they are not confined before, and only for a short time after, the operation, while quite the opposite is true if this precaution is overlooked.

The Field of Operation.—In hospitals where many operations are performed on the same day, so that the time spent over each case, immediately preceding an operation, is of importance, it may be well to prepare the field of operation on the day before, but this is done simply as a convenience, and not because it is better than it would be to prepare the field of operation immediately before beginning to operate. For months at a time I have followed the latter plan without having a single wound infected and other surgeons have had the same experience, hence there can be no good reason for insisting upon having the field of operation prepared one or more days before the operation. However, this may be done as a matter of convenience.

The important point in preparing a surface for operation lies in thorough washing with soap and water; anything that is done beyond this is of little importance, provided the washing process has been done carefully and thoroughly. In my practice the steps taken in preparing the field of operation are as follows: 1, thorough scrubbing with soft soap and warm water with a moderately stiff brush; 2, washing the surface with a piece of aseptic gauze with fresh water, because the epithelial scales which have been loosened with the brush are easily removed in this manner; 3, soaping and shaving off the field of operation; 4, washing again with aseptic gauze and sterile water; 5, washing the surface with commercial, *i. e.,* about ninety-five per cent., alcohol; 6, washing with a solution of corrosive sublimate, one part in two thousand.

In many cases only the first four, or the first five, steps were taken and always with the same results, consequently I am confident that careful washing of the surface with soap and water is the important part, but as there can be no harm in the other two steps they might as well be taken, so long as it is convenient in any given case.

There is still a distinct superstition in favor of the use of some antiseptic fluid for washing the field of operation, and so long as the fluid employed is harmless I believe that we are justified in using it. If this preparation is made just before beginning the operation it will suffice, if made on the day before the operation the surface must be protected against re-infection during the interval; this can be done by applying sterile gauze or cotton to the surface, holding it in place by means of a carefully applied bandage. On the following day the surface is once more washed with a piece of sterile gauze saturated with alcohol and is then ready for operation.

In order to prevent the infection of this field from any of the adjacent surfaces it is well to lay four sterile towels around the field of operation and hold them in place by means of safety pins. The space exposed should be large enough so that the towels need not be shifted during the operation, because such an act is likely to cause infection by carrying micro-organisms on the under surface of the towel from adjacent portions to the field of operation. During the operation these towels should be left in place, and in case they have become soiled they should be covered with fresh towels, but otherwise they should not be disturbed or removed. Again, when the operation has been completed the greatest care should be exercised to protect the wound while these towels are removed. This can be done very easily by placing a piece of moist, aseptic gauze over the entire surface of the wound and leaving it in place until all the necessary disturbance has been completed, then carefully sponging the surfaces around this pad, and at last removing the pad and covering the wound with proper dressings.

During the operation it is best to handle the tissues as little as possible, and to do this with instruments as much as may be, and as little as possible with the hands, and never to manipulate the patient's skin first and then the wound, because the epidermis almost always contains some micro-organisms which might be transferred to the wound.

A practice which should be guarded against consists in first sponging all about the wound and finally the wound itself. If the skin about the wound be sponged at all the same sponge should not be used in or upon the wound thereafter.

ANTISEPTIC AND ASEPTIC PREPARATIONS.

Preparation of the Hands.—What has been said concerning the preparation of the field of operation applies very closely to the preparation of the operator's hands before an operation.

The important point is to make sure of careful, thorough washing with soap and sterile water, then cleansing the space underneath the finger nails, then washing again, first with a moderately soft brush and then with a piece of gauze. I have found it an advantage to wash in a deep basin full of warm, sterile water, keeping the hands under water while scrubbing with the brush and washing with the gauze pad, and then to wash in sterile running water after the hands have been thoroughly scrubbed underneath the soap suds.

It is important above all things to keep the skin upon the hands smooth and soft and not covered with grooves and crevices. If the surgeon's skin is smooth it is much easier to keep the hands aseptic than if it has been roughened by the use of strong antiseptic solutions. There is a great difference in the skin of the hands of different surgeons, and consequently it is wise for each one to avoid the antiseptic solution which happens to be harmful in his case; and if all solutions have the same effect, it is wise simply to wash with soap and sterilized water, because smooth hands can be rendered perfectly safe in this way, while rough hands cannot be made safe by the additional use of any one of the various antiseptic solutions which have been recommended.

In my own practice I follow the washing with soap and water by the use of strong alcohol, and then a solution of corrosive sublimate, one to two thousand.

In hospital practice there are certain other precautions which are of exceeding great importance, largely in the way of prophylaxis, which will aid greatly in securing aseptic conditions. The most important of these is to keep the hands out of pus. In dressing suppurating wounds either forceps or rubber gloves should be used, so as to prevent the hands from touching pus. Operations should be performed early in the morning, before any one connected with the wounds has done any dressings. Puddling in pus is pernicious practice. This fact should be impressed most forcibly upon every one connected with the work.

Aseptic cases should always be operated first, and later those containing pus. In operations upon suppurating cases rubber gloves are used at the present time, but in former years, by taking the precautions indicated above, practically no infections took place, although no gloves were used. The same precautions should be taken in dressing the wounds—no suppurating wounds being dressed until all the clean wounds have been finished. Every evening before retiring the surgeon and all the assistants should scrub their hands with the same care that is employed in disinfection before an operation. It is absolutely necessary for every one connected with surgical work to develop an antiseptic conscience, because upon this depends the condition of the wounds rather than upon any special method.

It is a comparatively easy matter to secure an aseptic condition of the hands before the operation, but it requires great vigilance on the part of every one connected with an operation to maintain this condition throughout the operation. Unless each has an antiseptic conscience some one is likely to touch something which is not surgically clean and transfer the infectious material with his hands to the wound. In order to become thoroughly impressed with the ease with which this can be accomplished, every surgeon should take a practical course in a bacteriological laboratory extending over a number of months, because the same carelessness which will ruin a culture plate may cause a wound infection, and one really cannot fully appreciate how easily this occurs until after having had the experience of ruining a lot of pure cultures in a bacteriological laboratory.

RUBBER GLOVES.—If a surgeon has not a smooth, pliable skin, or if for any reason it seems difficult to obtain perfectly clean hands by washing, or if he has recently touched infected wounds, or performed autopsies, or dressed suppurating cases, it is well to protect the patient to be operated by wearing aseptic rubber gloves.

It should, however, be borne in mind that the surgeon loses much in dexterity in this way, and being deprived of the finer sense of touch his skill is quite materially impaired, and in some very delicate operations this impairment may be sufficient to deprive the patient of the slight chance he had of surviving the operation. Of course, this would apply to only a small proportion of all the patients operated upon, but it is large enough to be worthy of consideration.

It is quite different with the hands of assistants and nurses connected with operations. These can perform the less delicate duties which are entrusted to them as well with gloves as with bare hands, and consequently the additional safety which comes from covering their hands with aseptic rubber gloves is of sufficient importance to recommend their use.

DISINFECTION OF INSTRUMENTS.—All instruments, except knives, should be boiled for half an hour in a solution of a tablespoonful of baking soda to the quart of water before they are put away after operations, and again before they are used. The knives are washed carefully with pads of sterilized cotton, saturated with alcohol, before and after using.

Disinfection of Silk, Silkworm Gut, Horse-Hair, Drainage Tubes and Brushes.—This is accomplished by boiling in water for one hour, and preservation in five per cent. solution of carbolic acid in water, or in strong commercial alcohol, until used.

Catgut is prepared by immersing in sulphuric ether for one month, then for one month in strong, commercial alcohol, in which one grain of corrosive sublimate to the ounce has been dissolved, the solution being renewed once during this time. It is then preserved indefinitely in a solution of one part of iodoform, five parts of ether and fourteen parts of strong, commercial alcohol. It should never be handled by any one except the surgeon and the chief assistant. This catgut will last seven to ten days in tissues, according to the size used. It is employed in all ligatures, both in the peritoneal cavity and elsewhere, and for all buried sutures except in hernias and in the suturing of bones. For these purposes a chromicized catgut is employed, which lasts from fifteen to thirty days, according to size. This is prepared after the following formula: The catgut is immersed in ether for one month, then in a solution prepared in the following manner:

Take:

A.	Chromic acid	1 part.
	Water	5 parts.
	(Carefully dissolve.)	
B.	Take of Solution A.	1 part.
	Glycerine	5 parts.

Take Solution B and soak therein catgut for forty-eight to ninety-six hours, according to resistance wanted. Forty-eight hours will resist absorption by tissue for fifteen days; ninety-six hours will resist for thirty days.

C. Take catgut out of Solution B, rinse quickly in sterilized water to free it from Solution B, stretch and rub quickly with a hard, sterile towel to remove any of the Solution B which may still be adhering to it, wind on rods or slides at least three inches in length, and preserve indefinitely in the following solution:

D.	Carbolic acid, 95%	1 part.
	Glycerine	5 parts.

The catgut may remain in this solution for many months without depreciating in quality, or it may be kept for an indefinite period of time in the same solution as the ordinary catgut, composed of:

Iodoform	1 part.
Ether	5 parts.
Strong alcohol	14 parts.

The jar containing the ether in which the catgut is kept for one month should be filled only about one-half with the loose coils of ligature and then it should be filled with ether; it should be closed air tight and should be picked up every day or two and shaken in an inverted position in order to wash off any substance which may accumulate upon the surface of the coils. At the end of two weeks the ether should be removed and fresh ether substituted.

The same precautions should be taken with the solution of corrosive sublimate in alcohol. It is especially important not to wind the catgut tightly before placing it in these solutions, because this may prevent the solutions from penetrating all parts of the material.

One precaution is necessary in the use of catgut which has been prepared in this manner; it must not be placed in water before it is used at the time of the operation.

It seems that the iodine which is absorbed by the catgut in the iodoform-ether-alcohol solution makes it slightly antiseptic, which is probably an advantage.

I give only these two methods because they are so simple that they can be carried out as well in the simplest office of the country practitioner as in the laboratory of a well-organized hospital.

I have personally used catgut prepared in this manner in more than ten thousand operations, and the fact that I have adhered to this method of preparation, while I have changed almost every other detail in antiseptic technique in the meantime, shows that this very simple method must be satisfactory.

Observations have convinced me that what is ordinarily known and feared as catgut infection is quite unnecessary and that it depends upon one or more of five conditions which can easily be eliminated, viz.: 1, commercial catgut which may not be reliable; 2, catgut that has been saturated with antiseptic substances which cause a necrosis of the tissues included in the suture or ligature; 3, pressure necrosis due to tying the stitches too tightly; 4, infection of the catgut by careless manipulation by the surgeon or his assistants, the suture or ligature being permitted to touch objects not sterile; 5, infection of the catgut by the septic hands of the surgeon or his assistants.

Although drawing sutures or ligatures tightly enough to cause pressure necrosis cannot cause infection by itself, this is, nevertheless, a very common, if not the most common, cause of what is termed "catgut infection," because this furnishes a very favorable culture medium for any accidental infection which may occur during the operation and which would not develop into suppuration were not the tissues impaired by the constriction due to the undue tension placed upon the stitches or ligatures.

It has seemed to me that much of the improvement in aseptic results which many surgeons have attributed in their practice to the use of rubber gloves must be due to the fact that the wearing of gloves which have an exceedingly smooth surface has prevented them from tying their stitches and ligatures too tightly and that this explains the decrease in the amount of catgut infection in their practice.

This point is so important that I shall refer to it again in connection with the various operations in which its neglect is especially likely to cause mischief.

I have spoken at length concerning catgut, because if properly used it is certainly an ideal suture and ligature material, and it is important to have this material so that it can be invariably relied upon. Undoubtedly some manufacturers furnish catgut in a condition in which it can always be depended upon, but it is difficult to ascertain which of these firms are reliable, consequently it is best for each surgeon to prepare his own material. In large hospitals this can, of course, be delegated to a reliable person who is permanently employed and who fully comprehends the importance of his task. It is not well to assign assistants who frequently change their service to undertake this work, because then it is impossible for the surgeon to fix the responsibility.

All material that can be boiled for one hour is perfectly safe to use for sutures which are to be removed because such boiling ensures the sterility of the material at the time it is placed in the wound, provided it is not infected during its introduction. Of course, it may be infected while passing through the skin or from micro-organisms which progress along the suture between the time of its insertion and the time of its removal, or from micro-organisms existing in the blood which may become located at this point of traumatism, but if the stitches are not tied too tightly this result is not likely to occur, because there will not be a favorable culture medium along the stitch unless prepared by pressure necrosis.

DISINFECTION OF DRESSINGS.—All dressings are disinfected in a steam sterilizer, two hours being given for steaming and one hour for drying. The same treatment is given to aprons, sheets and towels.

DISINFECTION OF EVERYTHING COMING DIRECTLY IN CONTACT WITH WOUNDS.—The basins, instrument pans, jars for dressings, etc., are boiled in soda and water for one hour, then wrapped up in sterilized sheets until used. The tables are scrubbed with soap and water and then with 1 :1000 corrosive sublimate in water. They are always covered with a double sterilized sheet when in use. The ordinary pads of cotton and of gauze, sterilized in a steam sterilizer, are used in place of sponges in all operations.

DRAINAGE.—Drainage is always used in very large wounds such as breast amputations with removal of pectoralis major and minor muscles and axillary glands, also in thigh amputations, usually only for three or four days; never in herniotomies except for strangulated hernia complicated with gangrene, nor in small, clean wounds. The ordinary perforated rubber tube is employed. It is always used in wounds that are primarily septic; and whenever there is any doubt as to the aseptic condition of a wound we drain. I have found the use of an ordinary leather punch very convenient for making the necessary perforations in rubber tubing.

In the abdominal cavity I use glass tubes, closed at the end, having a number of small perforations toward the lower end. A strand of gauze is carried to the bottom of the tube to act as a capillary drain. A piece of iodoform gauze, folded about four double, is placed over the glass tube, which is then with this covering carried down to the point to be drained. In operations upon the pelvic organs it is carried to the bottom of the cul-de-sac of Douglas.

IRRIGATION.—We practically never use irrigation during operations, either in the abdominal cavity or elsewhere.

During the early days of my surgical work, as an assistant, I observed that wounds in abdominal sections healed more smoothly than in other operations, and the only real difference in the treatment observable was the fact that no irrigation was used in connection with the former, while it was invariably employed in the others. I consequently applied the same plan of treatment to all wounds as early as 1889, and I have since constantly operated dry in clean cases, and, since a number of years, also in cases containing pus. I have treated wounds in circumscribed tuberculous lesions by applying strong compound tincture of iodine, and then sponging the area with moist gauze sponges before tamponing with iodoform gauze or before closing with sutures. These wounds have progressed well, but I do not feel convinced that the iodine has been responsible for this fact. Very recently in tuberculosis of the joints I have applied strong carbolic acid to the surfaces of the bones for two minutes, and have then washed these parts thoroughly with strong alcohol until all of the carbolic acid seemed removed. I am convinced that irrigation is rarely of any real benefit and that it is frequently harmful in carrying infectious material to portions which might otherwise have escaped infection.

My observations have convinced me that it is an exceedingly simple matter to obtain primary union almost invariably if one has a reasonable system, *i. e.*, a system which keeps the attention of operator, assistants and nurses constantly on guard to prevent accidental contamination.

Whenever some new method is on trial in any hospital or clinic every one is interested and, consequently, accidental contamination is not likely to occur. It is for this reason that the various new methods are so successful in the hands of their originators.

A close observation of antiseptic and aseptic surgery from its beginning to the present time has led me to the conclusion that there is vast amount of difference and contradiction between the theories, which are at present generally accepted, and the practical results. So far as a scientific study of the subject is concerned, both the theoretical considerations, which are mainly based upon scientific experiments, and the practical observations upon wounds, must be borne in mind. So far as the welfare of any particular patient, or any set of patients, is concerned, only those facts which practice has shown to be of importance in order to secure primary union should be considered, because they will bear directly upon the welfare of a human being who has entrusted himself to our care. The following conclusions will serve to express my position from this point of view.

1. (a) Theoretically it is almost impossible to absolutely disinfect the skin of the patient and the hands of the operator. (b) Practically it is one of the easiest and simplest tasks to obtain a degree of surgical cleanness that will insure primary wound-healing.

2. (a) Theoretically, strong chemical disinfectants are indicated for the purpose of disinfecting the hands. (b) Practically, careful washing with the mildest, viz., soap and water and alcohol, is absolutely sufficient and very much safer for the patient, because hands roughened by the use of strong antiseptics are much more likely to become hopelessly septic than hands which are covered with smooth, healthy skin.

3. (a) Theoretically, it is extremely simple to keep the hands aseptic after they have been rendered so. (b) Practically, there is no more difficult task in any clinic, or during an operation in a private house, than to keep all interested hands clean after they have been disinfected.

4. (a) Theoretically, sutures passing through the skin and the deep tissues underneath are a menace to the patient, because they form a direct communication between the skin, containing staphylococci, and the deep tissues which are primarily sterile. (b) Practically, these stitches never cause an infection, unless drawn too tightly, in which case the resulting pressure necrosis is

the cause of the mischief because it furnishes these micro-organisms dead tissue to thrive upon.

5. (a) Theoretically, catgut sutures and ligatures are objectionable. (b) Practically, if applied properly, not tied too tightly, by a clean surgeon with clean assistants, they are absolutely satisfactory and not objectionable.

6. (a) Theoretically, it is as safe to operate upon clean cases after dressing suppurating wounds as at any other time. (b) Practically, surgeons who follow this practice always have a great amount of wound infection, on account of accidental contamination of something coming in contact with the wounds.

In order to have wounds heal without suppuration I believe the following conditions should be considered:

1. The surgeon, his assistants and nurses, must be habitually clean, and the skin of their hands must be free from irritation and roughness.

2. Their attention should constantly be directed toward the prevention of accidental infection.

3. The surgeon and his assistants should be careful not to breathe or speak into the wounds.

4. Tissues should not be exposed to unnecessary traumatism.

5. Sutures should not be tied tightly enough to cause pressure necrosis.

6. A reasonable system should be employed so that every one concerned can assist intelligently in preventing infection.

THE OPERATING ROOM.

The hospitals of this country are all supplied with suitable operating rooms, with the one criticism that many of them are badly-lighted. The light should come from the north and from sky-lights facing north, in order to have uniform light and not direct sun-light and not the overwhelming heat which is caused by sky-lights facing the sun.

In great cities operating rooms should be on the highest floor in high buildings, because the air contains much less street dust in the upper stories of a high building than near the ground, and consequently less infectious material is likely to accumulate in places from which an infection can be carried to the wounds.

Operations are always best performed in hospitals, and every city and town in the country should support a hospital suitable in size to the community tributary to it. This can be established and maintained at a small cost and is of great benefit to the community because it supplies a means of properly caring for cases which must otherwise be satisfied with generally very inefficient care. Moreover, it serves as the most powerful incentive for the entire medical profession in the community in which it is maintained because it furnishes a reasonable opportunity for advancement.

But many operations must for the present be performed in the homes of patients and here it might be considered more difficult to arrange an operating room. As a matter of fact there is but one point to be borne in mind in the arrangement of a room for operating, namely, infection, and that no wound infection is to be considered except from contact. Not that infection from the air is absolutely impossible theoretically, but that, practically, a wound remains aseptic unless infectious material has been placed in it by dirty hands, dirty instruments, appliances or sponges, ligatures, sutures or dressings, unless the infectious material existed in the patient's body at the time of operation. Of course the operator could infect a wound by breathing or speaking into it if his pharynx or air passages were infected.

But in any case in which a clean surgeon with clean assistants and clean appliances operates upon a clean patient, it can be expected with a fair degree of certainty that the wound will remain aseptic, no matter what the surroundings may be. On the other hand, the most perfectly appointed operating room cannot prevent a septic surgeon from having his wounds in clean patients suppurate.

It is best, when compelled to operate in a dwelling house, to choose the lightest room, to make as little disturbance as possible, and thus avoid stirring up dust, to arrange everything very simply and to utilize the least possible amount of furniture. An ordinary extension table will serve admirably for an operating table. Let it be drawn out so that there is a space of about three feet in the center and then two of the boards may be placed lengthwise so as to leave a notch on one side for the surgeon to stand and on the other side for his assistant. A quilt or blanket may be folded upon itself three or four times and placed lengthwise upon the table and this covered with a freshly laundered sheet. A small stand or table is placed at the side of the operator and covered with a sterile towel, and on this are placed the instruments, ligatures, sutures and sterilized dressings. Upon chairs or a bench, or another table, two or three basins are placed containing boiled water. Into one of these a sufficient number of tablets of corrosive sublimate are thrown to make a solution of 1-2000.

After preparing the surface to be operated, and the surgeon's hands as described in the previous section, the operation may proceed, but every one connected with the work must bear in mind throughout the operation that nothing must be touched by any one except those things that have been sterilized. If anything has been touched by accident or intentionally the hands of such person or persons, must again be disinfected.

It is not at all uncommon after making the most careful preparations for an aseptic operation to have some one who comes in contact with the wound, directly or indirectly, thoughtlessly produce an infection by handling some object which is not sterile. If it is necessary to depend upon unskilled assistants, it is well to cover their hands with sterilized rubber gloves and to virtually perform the operation alone. It is well to carry a good supply of sterilized towels and dressings in order to be able to cover everything in the vicinity of the operation.

Instruments may be carried sterile in a canvas roll and covered with a sterile towel and the ligatures and suture material may be carried in bottles. Basins may be placed in a wash boiler and sterilized by boiling while the preparations are being made for the operation.

Sterilized gauze may be cut in suitable lengths to serve as sponges.

From this it will be seen that it is not very difficult to prepare an operating room in an ordinary dwelling house, but no operator ever does his best work anywhere except in his regular operating room.

Whether the operation be performed in a well-appointed operating room or in a dwelling house, much will be gained for the patient if the surgeon appreciates the great value of simplicity. If only that is done which is actually of value to the patient, much will be gained for him, because it is through unnecessary manipulations that one is especially likely to carry infection to the wound.

ANÆSTHESIA.

Ether and chloroform are the only two general anæsthetics which seem to have stood the test of time; not that they are entirely safe, nor that they are entirely satisfactory, but rather that they are less unsafe and less unsatisfactory than the other substances which have come into use and been discarded again. In the use of chloroform there is a considerable amount of danger at the time of its administration, and in the use of ether there is some danger from pneumonia following recovery from the anæsthesia because of the great irritation of the respiratory tract.

The various contra-indications will be considered in connection with the clinical cases in which they will be found. For the present only points of general application will be considered.

The careful general examination which was described in the first section will have determined any pathological conditions of the heart, the kidneys and the lungs, the three organs especially to be considered by the anæsthetist. If one or more of these organs have been found to be pathological it will be wise for the anæsthetist to be even more cautious than he would otherwise be, if this is possible, and for the surgeon to limit his operation to the very shortest consistent time. The induction of anæsthesia should be somewhat slower and the anæsthesia just sufficiently profound to permit the operation without disturbance or interruption by the patient.

Singularly, in my experience patients suffering from organic heart lesions have never had any serious or alarming difficulty during the administration of an anæsthetic, while this is not true of patients whose heart, lungs and kidneys were evidently normal. No one would reason from this that the former class of patients are better subjects for the administration of anæsthetics, but rather that the presence of their unfavorable condition caused the anæsthetists to exercise unusual care in all of these cases.

From this it would seem that it is perfectly safe to give anæsthetics in cases suffering from valvular heart lesions, provided this is known at the time the anæsthetic is administered. I believe that it also shows that if the same care which has been employed in these cases were regularly taken in all cases, the present low mortality from anæsthesia would be still further reduced.

The method which has been most satisfactory in my own practice consists in first quieting the fears of the patient, then applying across the patient's eyes a pad of sterilized gauze, six or eight thicknesses, and about three inches wide and eight inches long, saturated with warm water, to protect the eyes against irritation from the anæsthetic, and incidentally to soothe the patient by having the eyes closed. The face is then anointed with vaseline to prevent burning with chloroform. Then the patient is told to count aloud slowly and after the anæsthetist. This causes him to breathe deeply and at the same time to divert his attention from the anæsthesia.

An ordinary Esmarch chloroform mask covered with two thicknesses of gauze is then placed over the mouth and nose and chloroform is dropped upon this very slowly but continuously, care being taken to constantly change the point upon which the drops fall so as to apply the chloroform to different parts of the mask with some uniformity.

So long as the patient counts with loud voice, after the anæsthetist, his breathing is fairly regular and there is little danger in the administration of chloroform, provided the gauze covering the mask is not too thick to permit a sufficient amount of air to enter with the chloroform (for this reason only two thicknesses of ordinary gauze should be used).

After the patient has been thoroughly anæsthetized with chloroform, and for at least one minute before the operation is begun, I have ether administered with the same mask, also by the drop method, with the difference, however, that the gauze is kept thoroughly saturated with ether and that four layers of gauze are placed on the Esmarch mask instead of two.

When a surgeon is compelled to operate without a skilled anæsthetist, which is a very common experience for the practitioner in the country, the administration of the ether can safely be placed in the hands of any one, provided this method be employed. The surgeon can prepare everything for the operation, he can then give the chloroform himself until the patient is asleep, then after giving ether for a minute or more this can be placed in the hands of any intelligent person and the surgeon can again disinfect his hands and proceed to perform the operation. Even in hospitals where there are skilled anæsthetists this method is satisfactory.

If for any reason the patient does not take ether well he will frequently take chloroform without disturbance, and it is usually well to change the anæsthetic in any case in which there seems to be difficulty with giving one or the other of these two. I have, however, adopted the rule never to return to the use of chloroform in any given case in which this anæsthetic is not well taken, because this might result in a serious or even fatal accident.

If a patient does not take ether well it may be disagreeable to continue its use, but it is nevertheless ordinarily safe.

There is no sign of danger in the administration of anæsthetics upon which one can depend absolutely, but there are a number of signs which should always have careful attention when they appear. In most cases of danger respiration is at first impaired; in some cases the respiration and the circulation suffer at the same time; while in others the heart stops beating suddenly before the respiration ceases.

In time of trouble we have found greater benefit and prompter relief by first pressing forcibly upon the chest several times, in order to force out from the lungs as much as possible the air laden with chloroform, and then by means of artificial respiration supplying pure air in its place.

If no air seems to enter the lungs upon attempting artificial respiration it is well to rapidly place a gag between the teeth and with the finger to raise up the epiglotis away from the larynx; this can sometimes be accomplished very quickly by pulling the tongue forward rapidly with a pair of tongue forceps.

The operator can frequently recognize impending danger to the patient from the anæsthetic by the lack of bleeding from the wound and by the dark color of the blood, indicating insufficient aëration.

Above all things, the anæsthetist should give his entire attention to his work and should never crowd the anæsthetic in order to hasten the anæsthesia.

Local Anæsthesia.—The most convenient local anæsthesia for very slight operations consisting only of an incision can be accomplished by covering the surface with salt sterilized by heating and rubbing a piece of ice over the surface for a few moments. This will freeze the surface almost instantly and will permit the surgeon to make a painless incision.

Cocain.—When general anæsthesia is contra-indicated, local anæsthesia may be secured by first injecting the skin with a one per cent. solution of cocain in sterilized water and then saturating the deeper tissues with the following solution:

Cocain	2
Carbolic acid	5
Sodium chloride	6
Sterilized water	1000

The same end can be accomplished by injecting a few drops of a one per cent. solution of cocain into the substance of a nerve supplying the area in which an operation is to be performed.

Generally speaking, however, local anæsthesia has not been very satisfactory except in a limited class of cases.

Spinal anæsthesia has not as yet secured a position in surgery sufficiently firm to be considered as an established method.

Hernia.

GENERAL CONSIDERATIONS.

In this chapter will be considered only the five common forms of hernia: inguinal, femoral, umbilical, ventral and hernia of the linea alba. The history, diagnosis and differential diagnosis will be treated in connection with cases representing each one of these varieties.

Ætiology.—These forms of hernia, with the exception of ventral hernia following an operation or an injury, occur at points which are naturally weak because of the normal openings through the abdominal wall during fœtal life. In many cases of the inguinal, and in some of the umbilical variety, these openings have never been closed, so that the hernia is congenital.

Frequently the tissues around the hernial opening are much weaker than normal, so that they will give way much more easily. This is true especially in patients who have one or both parents with a similar defect. (More than one-third of all patients suffering from hernia give a history of hereditary tendency in this direction.)

The fact that the spermatic cord passes through the inguinal canal makes this form of hernia most frequent. A long omentum with its ability to become insinuated in any opening, however small it may be, is a common predisposing cause in the formation of hernia. The same is true of a long mesentery.

The presence of a great quantity of fat in the abdominal wall greatly weakens this structure, first, from the fact that lobes of fat will invade the natural openings and will separate the connective tissue and muscular layers whose function it is to prevent the formation of hernia; secondly, from the fact that with the accumulation of great quantities of fat in the connective tissue spaces of the abdominal wall the muscles themselves become softened on account of a certain amount of fatty degeneration which takes place in these tissues. Moreover, at the same time there is always a corresponding increase in the amount of fat within the abdominal cavity which does not only favor the formation of hernia because of its weight, but also because it increases the intra-abdominal pressure.

Exciting Causes.—The chief exciting cause is increased or abnormal intra-abdominal pressure. This may be very violent and of only short duration, as in lifting heavy weights, falling a great distance or with very great force, violent coughing or sneezing, etc. In such case the tissues are virtually torn, making an opening through which the hernial contents protrude. Again, the abnormal intra-abdominal pressure may be less violent and more continuous, as in cases where there is a long-continued cough, chronic constipation, or an obstruction of the urethra on account of phimosis, stricture, enlargement of the prostate gland or stone in the bladder. The same is true of gaseous distention of the stomach and intestines due to digestive disturbances. Adhesions following peritonitis due to appendicitis, or infection through the Fallopian tubes, is likely to have the same effect. In short, anything which will cause abnormal intra-abdominal pressure, either acute or chronic, is likely to bring about the formation of a hernia, especially if there is a predisposition present.

General Treatment.—In many of these cases a properly-fitting truss will secure for the patient a relative degree of comfort and safety, but necessitates the wearing of an apparatus which is at best unpleasant and, in summer especially, annoying, uncomfortable, fatiguing and sometimes painful. Aside from this the patient is constantly exposed to the risk of having strangulation, which is, under all circumstances, very dangerous, and quite a considerable proportion of all persons suffering from hernia lose their lives sooner or later as a result of this sequel. Many persons suffering from hernia find it difficult to compete with others of their rank and qualifications because of this handicap.

Preparatory Treatment.—In a general way the preparatory treatment is the same for these patients as for patients about to undergo any other serious operation, with the addition, it may be, of some steps which are intended to eliminate as much as possible some of the predisposing causes.

It is well, for instance, to place patients who have a great accumulation of fat in the abdominal wall upon a systematic course of treatment for the reduction of this fat, if possible, before the operation is performed.

We have usually employed the following diet with excellent results, the patient losing from three to ten pounds per week; the general appearance and strength improving constantly during this treatment. Many of these cases have lost from thirty to sixty pounds in weight, and in a few very obese patients the loss has exceeded one hundred pounds.

The diet may be varied to suit the individual case.

DIET LIST.

Breakfast.—		
Tea	4½ oz.	—A very small cup.
Milk	⅔ oz.	—One and a half tablespoons.
Sugar	75 grs.	—A small lump.
Bread	375 grs.	—A very small slice.
Dinner.—		
Sour Wine	3⅓ oz.	—A wineglassful.
One egg, or lean meat,	10 oz.	
Lettuce with vinegar	1⅔ oz.	
Vegetables	1⅔ oz.	
Bread	375 grs.	
Supper.—		
Wine	½ pint.	
Water	½ pint.	
Quarter small chicken, or 8 oz. lean meat.		
One egg.		
Bread	375 grs.	

Drink nothing during the meal, nor for an hour before or after, except as given in the above list. When thirsty during the day drink a little sour wine or sour lemonade.

Aside from this the patient is advised to walk systematically, beginning with a walk which is perfectly comfortable on the first

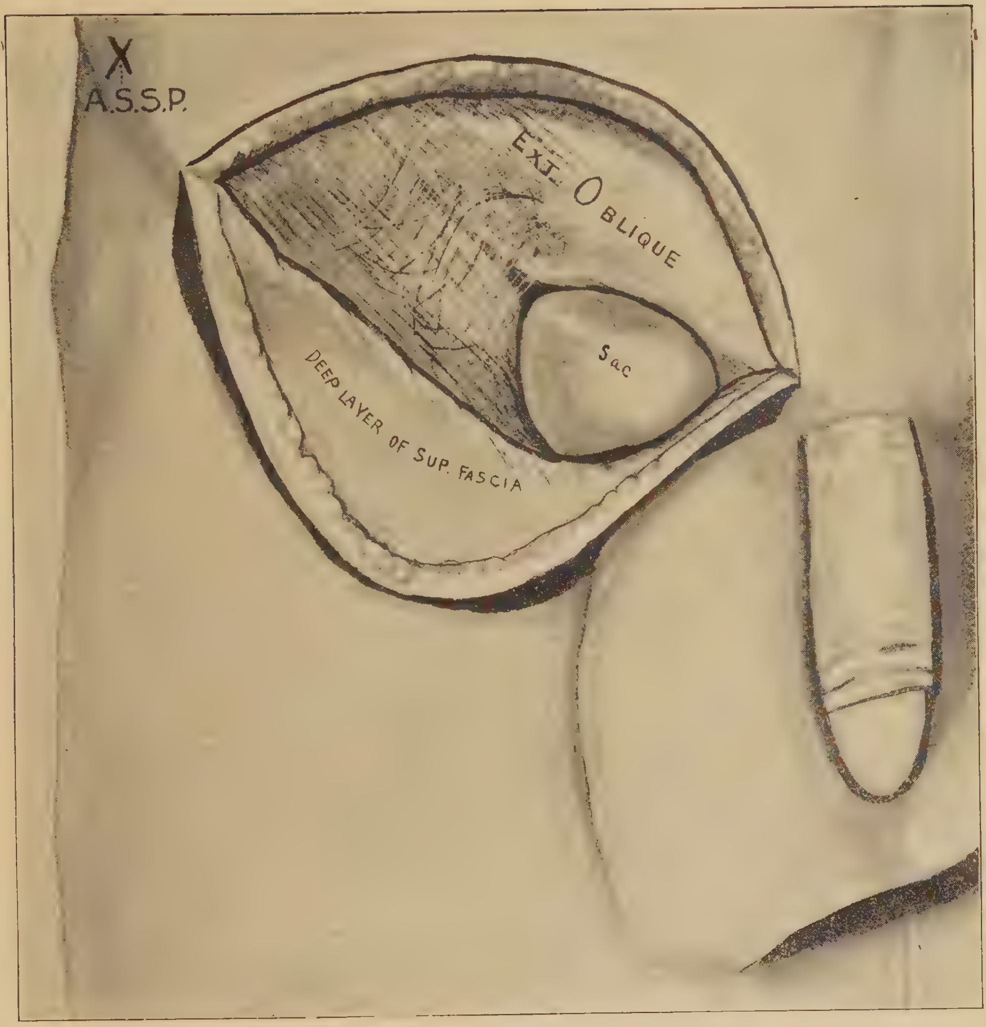


PLATE I.
INGUINAL HERNIA.

Shows the anatomical structures exposed by the primary incision. The hernial sac bulges through the external abdominal ring and hides the tissues of the spermatic cord. The fascia of the external oblique abdominal muscle shows a point of weakness directly over the inguinal canal, quite common in inguinal hernia.

Taken from Professor A. H. Ferguson's original drawings, with his kind permission.

day and increasing it one-fourth mile each day until it reaches from six to twelve miles. At first the habitual speed of walking should be practiced, but this should be increased until the patient walks the entire distance at a maximum speed for his strength. During this walk he should breathe very deeply through the nose, the lips remaining closed.

Other hygienic measures like hot baths followed by cold shower, massage and various gymnastic exercises may be added to this plan.

This will not only reduce the amount of fat in the abdominal wall, but also to a great extent in the omentum and mesentery and underneath the peritoneum, thus reducing the intra-abdominal pressure to a marked extent, and at the same time increasing the firmness of all the tissues in the vicinity of the hernia.

If there is an abnormal amount of intra-abdominal pressure due to gaseous distention of the abdomen caused by indigestion this should be corrected. The same is true of constipation, or obstruction to the passage of urine, or chronic bronchitis. In short, so far as it is possible it is wise to eliminate the predisposing causes to the formation of hernia before the operation for radical cure is performed.

The same should be borne in mind again in the after-treatment. Provision should be made against the recurrence of these predisposing causes after the patient has once been relieved of his hernia by an operation.

INGUINAL HERNIA.

Our patient is thirty-eight years of age and a farm laborer by occupation. One sister died at eighteen and one brother at twenty years of age. His mother suffered from a rupture. Patient had whooping cough in childhood and typhoid fever at eighteen; was weakly and ill most of the time until the age of twenty. He had pneumonia at the age of thirty-three. At the age of thirty patient felt some pain in both inguinal regions, after climbing a tall tree. One week later he jumped suddenly out of bed, when he experienced a pain in the left inguinal region. At this time he noticed a small bulging over the left inguinal canal. He wore a truss for three years, when he was apparently cured. At this time he suffered from pneumonia, coughed a great deal, and when he had recovered from this sickness he found that the hernia had returned. He again wore a truss, which retained the hernia, but the hernial opening showed no further tendency toward closing.

Three weeks ago, after patient had been working hard in the field, he noticed a slight bulging on the right side, which has increased constantly until it has now attained the size of a hen's egg. Neither hernia has caused pain. There has been no tendency towards strangulation. When the patient is in the recumbent position the herniæ always reduce spontaneously.

Present Condition.—The patient is fairly well nourished. Lungs, heart, kidneys and abdominal organs are normal; the tongue is slightly coated; appetite good; bowels regular.

The abdomen is normal except for a marked weakening over both internal abdominal rings, causing a bulging the size of a hen's egg over each inguinal canal when the patient is in the erect position, and this is still further exaggerated upon coughing. This is a little more marked upon the right side. Patient complains of a feeling of weakness at this point in the abdominal wall and he is compelled to support this point with his hand when he attempts to lift any weight. The right inguinal canal easily admits the tips of two fingers, the left the tip of one finger.

The contents of the canal can be easily reduced into the abdominal cavity by means of a slight amount of pressure, and upon taking the recumbent position the bulging disappears at once.

Diagnosis.—All of the conditions are so clear in this case that there can be no difficulty in making a diagnosis of uncomplicated double inguinal hernia.

Differential Diagnosis.—It is almost impossible to make a wrong diagnosis in simple cases of reducible inguinal hernia, but it is quite different in case some complication exists. The most common of these consists of adhesions. If some of the hernial contents, such as the omentum or intestine, are adherent to the hernial sac, or if the hernia is complicated with an acute inflammatory condition, it may be mistaken for an inflammation of the inguinal lymphatic glands.

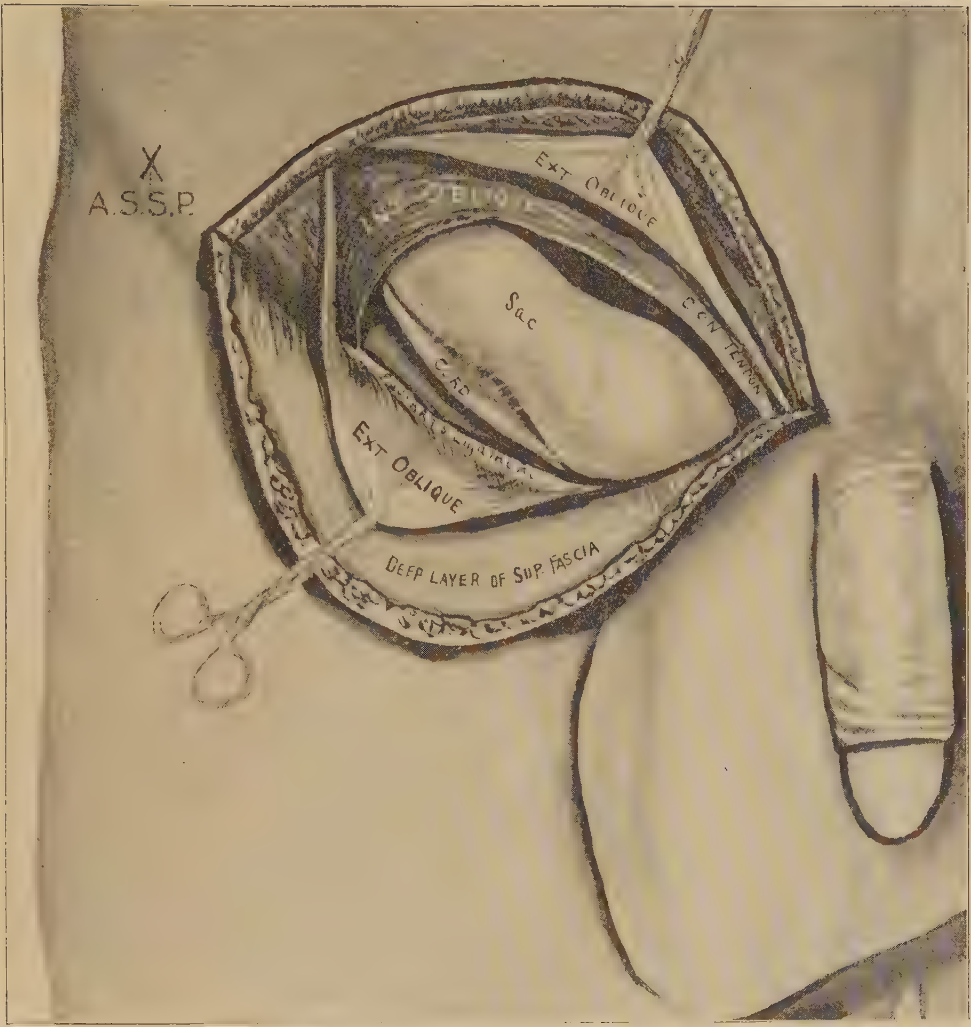


PLATE II.
INGUINAL HERNIA.

Represents all of the anatomical structures laid bare, the first incision having extended down to the fascia of the external oblique abdominal muscle, the next incision having split the fascia of the external oblique, which has been retracted, exposing the hernial sac, the spermatic cord, Poupart's ligament, the internal oblique and the conjoined tendon.

Taken from Professor A. H. Ferguson's original drawings, with his kind permission.

The latter condition is, however, usually preceded by an infection of the urethra or the prepuce, or an infection of some portion of the lower extremity such as may come from an infected corn or from some slight abrasion of the skin.

If the hernia has extended down into the scrotum it may be difficult to differentiate it from hæmatocele or a hydrocele, although one can usually see rays of light shining through the latter by placing a small tube against the scrotum and holding a light on the opposite side. Moreover, by grasping the tissues opposite the external abdominal ring between the finger and thumb one can always feel the tissues of the cord above a hydrocele, but not above a hernia, except in children suffering from an irreducible hydrocele of the cord, to be considered later. On the left side a large varicocele is sometimes mistaken for a hernia and *vice versa.* This, however, should not occur, because the enlarged veins have a peculiar, wormlike feeling in varicocele which can be easily recognized.

Occasionally an inguinal hernia occurs in the same patient with a femoral hernia, and, in a few cases, instead of extending in the direction of the inguinal canal into the scrotum an inguinal hernia will descend to the upper portion of the scrotum and then be deflected outward to a point opposite the femoral ring, and thus have the appearance of a femoral hernia.

In a similar manner a femoral hernia, instead of descending after protruding through the femoral opening, may extend upward and form a swelling in the region of the inguinal canal and thus have the appearance of an inguinal hernia. So long as the hernia is reducible in either case the diagnosis can readily be made, because the opening through which the hernia has protruded can be demonstrated by digital examination; if this is above Poupart's ligament it is an inguinal, if below, a femoral hernia.

Tumors are very rare in the region of the inguinal canal, but I have seen a lipoma and several sarcomata which had been diagnosed as inguinal hernia.

ÆTIOLOGY.—There can be no doubt but that there is an hereditary tendency in many families to the formation of hernia. If both parents in a family suffer from this defect some of the children are almost certain to be afflicted in the same manner. The well-known fact that especial defects in families are likely to be inherited is shown in this disease. There is a much larger proportion of herniæ in nationalities in which intermarriage between first cousins is freely practiced than in others in which this is forbidden.

The natural opening in the inguinal canal in the male, due to the descent of the testicle, makes the occurrence of inguinal hernia much more common in the male than in the female.

Long continued, exhausting diseases cause a relaxation of the tissues of the abdominal wall, which predisposes to the formation of hernia. In this instance the patient suffered from whooping cough and typhoid fever before the occurrence of the first, and from pneumonia before the occurrence of the second hernia.

Increased intra-abdominal pressure is one of the most common direct causes of hernia. In this patient this condition was present during the attack of whooping cough and, later, during the cough accompanying the pneumonia. The immediate cause for the giving way of the internal abdominal ring, however, was the abnormal exertion employed in climbing a tree. The quick motion which caused the protrusion of omentum probably had nothing to do with enlarging the internal abdominal ring, but simply forced the omentum into the open space. It is usually some sudden exertion which accomplishes this, such as lifting or sneezing or stepping down unexpectedly.

In a considerable proportion of these cases the inguinal canal had never been completely closed after the descent of the testicle, and it requires only a slight dilatation of the internal abdominal ring, followed by a sudden increase of pressure, to force down some of the intra-abdominal contents, and the hernia is established. A long, thin omentum greatly favors this last step.

Indications for Operation.—In this patient the hernia can be readily reduced and retained by means of a truss, hence the conditions are very similar to those discussed in connection with femoral hernia. We can undoubtedly relieve this patient of the discomforts of wearing a truss, and the dangers of a possible strangulation, by a safe operation, which will disable him for work not longer than one month. There can consequently be little doubt concerning the wisdom of his choice of treatment.

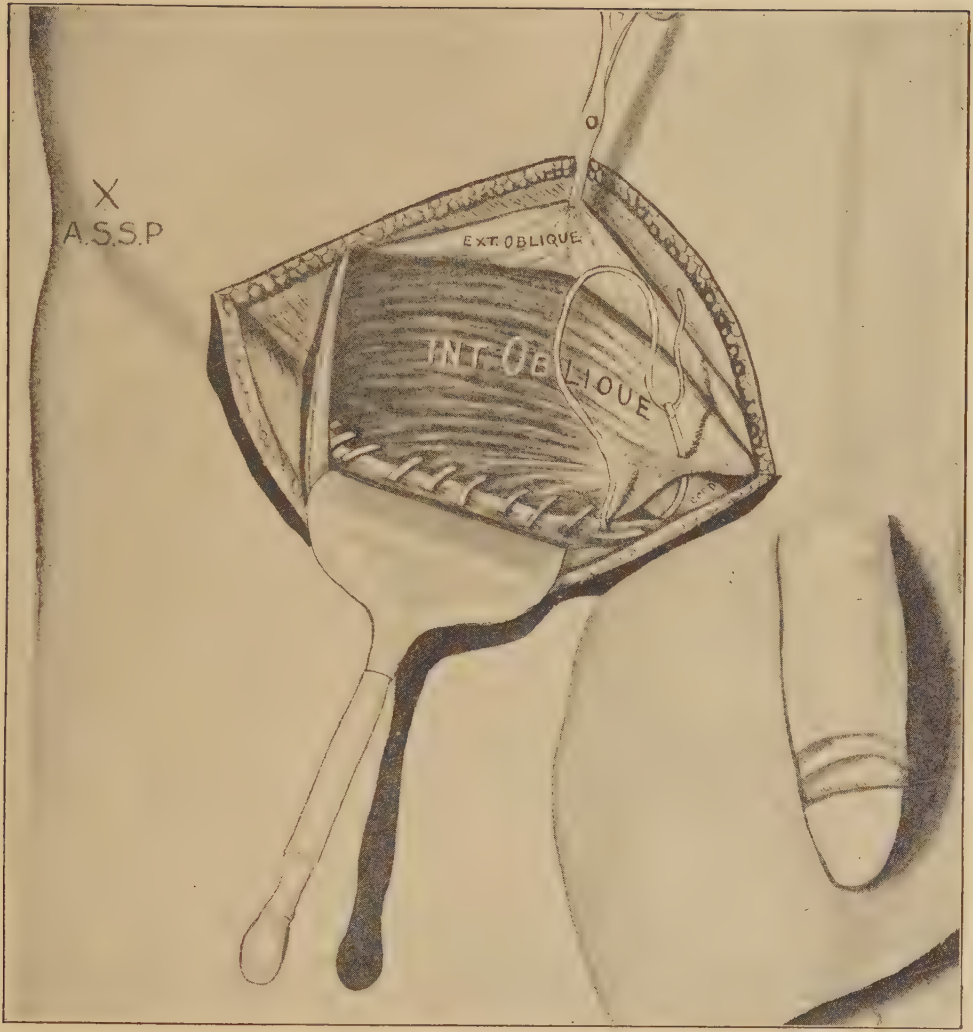


PLATE III.
INGUINAL HERNIA.

Represents the fascia of the external oblique retracted, the internal oblique and conjoined tendon sutured to the ledge in Poupart's ligament, the spermatic cord remaining undisturbed in its normal position.

Taken from Professor A. H. Ferguson's original drawings, with his kind permission.

Preparatory Treatment.—This should be the same as in all of the other forms of hernia.

Operation.—An incision ten to fifteen centimeters in length is made in the direction of, and over the center of, the inguinal canal, beginning at a point two centimeters above the scrotum. This is carried through the skin, superficial fascia and fat, exposing the fascia of the external oblique abdominal muscle with the hernial sac protruding at the lower end of the inguinal canal, as shown in Plate I.

The fascia of the external oblique abdominal muscle is now slit up in the direction of the inguinal canal to a point five centimeters above the internal abdominal ring. The edges of this are now carefully retracted, and the soft tissues, consisting of fat, portions of the cremasteric muscle and connective tissue, are carefully dissected away, leaving the anatomical structures plainly exposed, as shown in Plate II. The fat can be removed most perfectly and rapidly by stripping between the layers of a piece of moist gauze held between the fingers and thumb. This exposes the ledge of Poupart's ligament and the fascia of the external oblique abdominal muscle below, the internal oblique abdominal muscle and transversalis fascia and the fascia of the external oblique above, and between these the hernial sac and the spermatic cord; and to the outer side, the fibers of the internal oblique abdominal muscle, as shown in Plate II.

The hernial sac is now carefully dissected out, great care being taken not to injure the tissues of the spermatic cord, which in this case we find continuous with the upper portion of the sac, showing that we have to deal with a congenital hernia, the tunica vaginalis having remained open since birth, the internal ring, however, being so nearly closed that there was no protrusion of omentum until many years later.

In order to facilitate the separation of the upper portion of the sac I will open the latter. I find that it contains a long, thin portion of omentum. This is drawn down gently as far as it will come without using any force. It is spread out and the vessels are ligated by passing around them catgut ligatures at each point at which they can be seen by holding up the spread omentum to the light. Then the omentum is cut away beyond these ligatures, preserving enough tissue to prevent slipping. The sac is now dissected up to a point quite within the abdominal cavity; it is then transfixed with a needle carrying a double catgut ligature and tied so as to prevent slipping. The sac is then cut away, care being taken to leave enough tissue to prevent slipping of the ligature. The stump is now retracted within the abdominal cavity by the elasticity of the peritoneum.

The steps which have just been described are exceedingly important, especially the careful removal of the soft tissues, the hernial sac and the omentum, because neglect of any one of these points would tend to cause a recurrence.

The internal oblique abdominal muscle and the transversalis fascia are now carefully sutured with interrupted sutures of chromicized catgut to the ledge upon the under surface of Poupart's ligament, the edge of the fascia of the external oblique being carefully retracted, as shown in Plate III.

In applying these sutures, it is well to bear in mind the possibility of injuring the deep epigastric vessels by carelessly grasping the tissues above with the stitch, or the iliac vessels below in the same manner. The simplest way to avoid injuring the latter is to insert the needle through Poupart's ligament from within outward.

The fascia of the external oblique abdominal muscle is then sutured as shown in Plate IV. The skin is then sutured over all.

This method, known as Ferguson's operation, has the advantage of closing the inguinal canal perfectly, firmly and permanently, and at the same time leaving the tissues of the spermatic cord undisturbed.

Since the publication of this method by Dr. Ferguson I have used it because it combined all of the good qualities of Bassini's operation, which I had practiced with most excellent results for ten years previously, and has the advantage of being simpler in that it does not disturb the tissues of the spermatic cord.

In order to illustrate the latter method, however, especially as it is the method still in use by most of the best surgeons, I will perform Bassini's operation upon the other side. For the sake of simplicity we can make use of the illustrations just shown of a

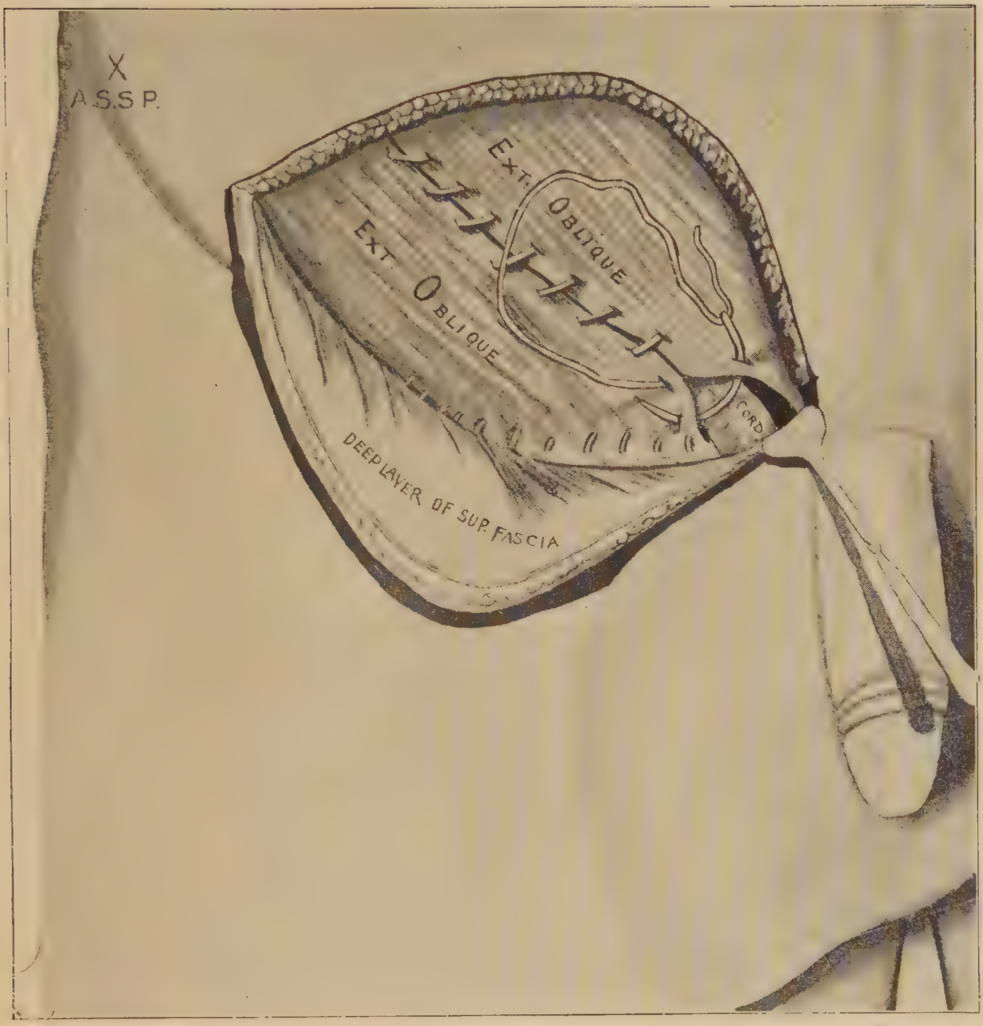


PLATE IV.

Inguinal Hernia.

This figure shows the sutures attaching the internal oblique and transversalis abdominal muscles to Poupart's ligament, in place and over these tissues the fascia of the external oblique sutured in a separate layer, the spermatic cord issuing at the lower angle. Suturing the skin and superficial fascia over all will complete the operation.

Taken from Professor A. H. Ferguson's original drawings, with his kind permission.

herniotomy upon the left side, because all the steps, with one exception, will be identical.

The incision, the exposure of the anatomical layers, the removal of the soft tissues and the hernial sac are the same. In the last step, however, we find this difference. The sac is not continuous with the tissues of the spermatic cord, but is simply adherent by means of delicate fibers of connective tissue, showing that on this side we have an acquired and not a congenital hernia.

We also find that the sac contains no omentum. It is likely that this descended into one side occasionally and then into the other, or the other side may have contained omentum and this side intestines regularly. Having disposed of the hernial sac as before, we make the step in the operation in which the two methods differ. The tissues of the spermatic cord are carefully loosened from all of the surrounding tissues. Then we elevate it from the floor of the inguinal canal by means of a blunt hook and insert the stitches of chromicized catgut, as shown in Plate V. These stitches are applied precisely as before, grasping the same tissues. Two of them being applied above the cord and the others underneath the elevated cord, so that the latter passes out between the second and third stitch, counting from the outer side. Six stitches will usually suffice. They can be applied with greater regularity if they are not tied until all are in place. The same care must be taken to prevent the injury of the deep epigastric and iliac vessels as before.

The two stitches above the cord are of the greatest importance, because it is at this point that recurrence is likely to take place. After these stitches have been tied the fascia of the external oblique abdominal muscle and the skin are sutured as before.

VARIATIONS IN TREATMENT.—Occasionally the tissues to the inner side of the inguinal canal are so attenuated that it seems difficult to secure a permanent closure of the hernial opening. In this case it may become necessary to utilize the rectus abdominis muscle —Bloodgood's method. The fascia covering the outer edge of the rectus abdominis muscle is split longitudinally and the muscle is then sutured to Poupart's ligament, together with the conjoined tendon of the internal oblique and transversalis.

Prognosis.—Both of these operations, if performed with great care, will result in a permanent cure of inguinal hernia in almost every case, provided that the patient prevents for the future the occurrence of abnormal intra-abdominal pressure.

In the female patient the operation is performed precisely in the same manner, with the exception that the round ligament, which corresponds to the tissues of the spermatic cord, is practically disregarded.

FEMORAL HERNIA.

This patient, an unmarried woman twenty-eight years of age, a servant by occupation, gives the following history:

Her parents, brothers and sisters are well. She was well and strong as a child; menstruation since the age of sixteen, regular and normal. She has worked hard as a servant since the age of twenty. At the age of twenty-two she first noticed a slight protrusion in the region of the left femoral canal. This has increased gradually. It is now the size of a hen's egg. She can reduce it readily, but suffers from a dragging pain when working hard; in fact, even when she is compelled to stand or walk she is very uncomfortable.

Present Condition.—Well-nourished young woman, whose various organs are normal, both as regards their anatomical condition and physiological functions. Upon standing a swelling develops in the left femoral region to the size of a hen's egg. The swelling disappears instantly upon resuming the recumbent position, and an opening that will admit the tip of a finger can be felt under Poupart's ligament. There is an impulse upon coughing or straining.

The history and physical examination leave no doubt as regards the diagnosis in this case. It is an uncomplicated case of femoral hernia.

Differential Diagnosis.—In case a portion of the omentum becomes attached to the lining of the hernial sac, on account of inflammatory adhesions, it may occasionally be mistaken for lymphadenitis of the glands normally found in this region.

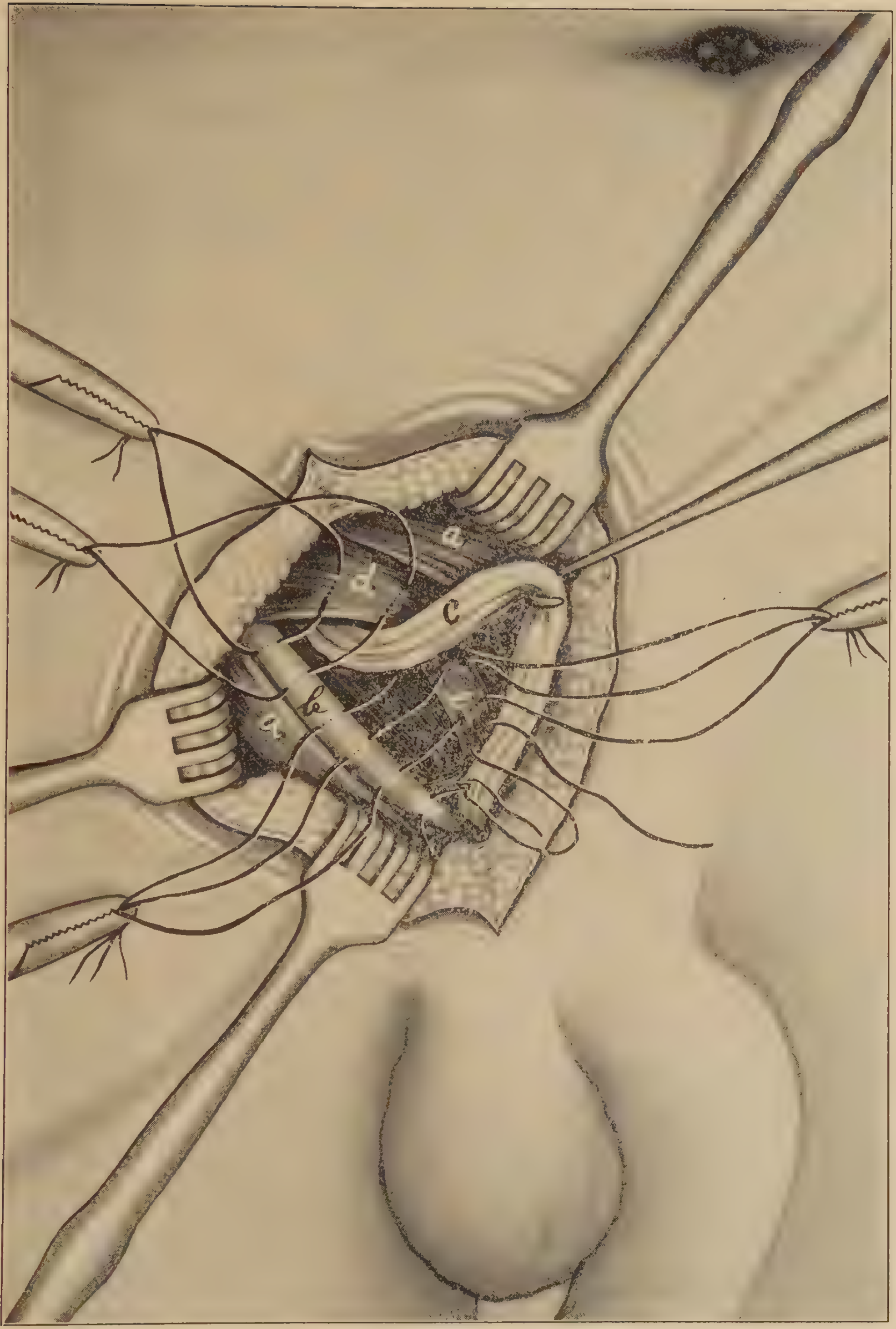


PLATE V.
Inguinal Hernia.

Represents the method of insertion of sutures in Bassini's operation for radical cure of inguinal hernia; (a) representing the fascia of the external oblique abdominal muscle; (b) Poupart's ligament; (c) the tissues of the cord; (d) the fibres of the internal oblique and transversalis muscles; (e) their inner portion known as the conjoined tendon.

Lipoma has been mistaken for femoral hernia; the same is true of sarcoma. All of these conditions can, however, be eliminated in this case, because there is a definite femoral canal when the swelling is reduced, and there is a distinct impulse upon coughing or straining. Moreover, the condition is too chronic for either sarcoma or lymphadenitis.

The history is interesting from one point alone, which probably explains the origin of this hernia.

Ætiology.—So long as this patient remained at home and simply performed her share of the duties in the household of her parents, who were working people with a small income, she remained perfectly well. She went into service as a domestic and was compelled to labor beyond her strength, and consequently soon became relaxed. When she lifted heavy wash boilers, and overexerted herself in other ways, immediately the point of weakness in her femoral region became apparent. The peritoneal protrusion formed a hernial sac and as the omentum or intestine was forced into this sac the latter slowly increased, until it acquired its present size.

Femoral hernia is almost always acquired at a time when the patient is exposed to an abnormal strain, most commonly during the child-bearing period or, as in this case, during a time of hard domestic service.

Treatment.—The treatment in this case may be palliative, by means of a truss which could undoubtedly be adjusted, or curative, by means of an operation.

Indications.—There are no strong indications in this case. Her suffering is not severe, she is not disabled for work, nor is she in great danger of becoming worse. The only danger is from strangulation, and this is not great in the case before us, because the opening through which the hernial contents enter the sac seems to be sufficiently large to permit an easy reduction. Should there develop a more marked disproportion between this part and the remaining portion of the sac, strangulation would be more likely to occur. Whatever is done for this patient is consequently not a matter of necessity, but a matter of choice.

Although a truss would probably retain this hernia, it is not to be chosen lightly, because it will be a hardship for this patient to be subjected to the discomfort of wearing this very uncomfortable instrument for the remainder of her life. Moreover, such a course would be connected with considerable expense. Trusses have to be changed and repaired and are never comfortable to wear.

On the other hand, in choosing an operation for this condition we must be reasonably certain of three conditions, viz.: 1. It must be almost absolutely safe, because this patient is now in good health and is likely to remain so for a long time if no operation be performed, therefore we take a great responsibility in advising an operation if it is not safe. 2. The result must be permanent. 3. The patient must not be disabled for work for too long a time.

I believe that all of these conditions obtain under right management. 1. There is practically no danger in the operation if skillfully performed with proper surroundings. 2. The relief obtained is permanent. 3. The patient will have to abandon her work for less than one month.

I will consequently advise an operation for the radical cure of this hernia.

The ordinary preparations of the patient in general and the field of operation have been made, and we may proceed with the operation.

Operation.—An incision is made over the most prominent portion of the swelling, either parallel with the axis of the body or with Poupart's ligament.

The center of this incision should be over the middle of the femoral canal.

After the skin and superficial fascia have been severed it is best to lift the underlying tissues by means of two pairs of dissecting forceps, in order to protect each successive layer of tissue. This will greatly facilitate the operation and at the same time increase the safety of the patient.

It is usually not difficult to recognize the sac on account of its smooth, hard structure, but if the tissues have been severely irritated by pressure from a truss it is often more difficult. It can, however, always be recognized after it has been opened on account

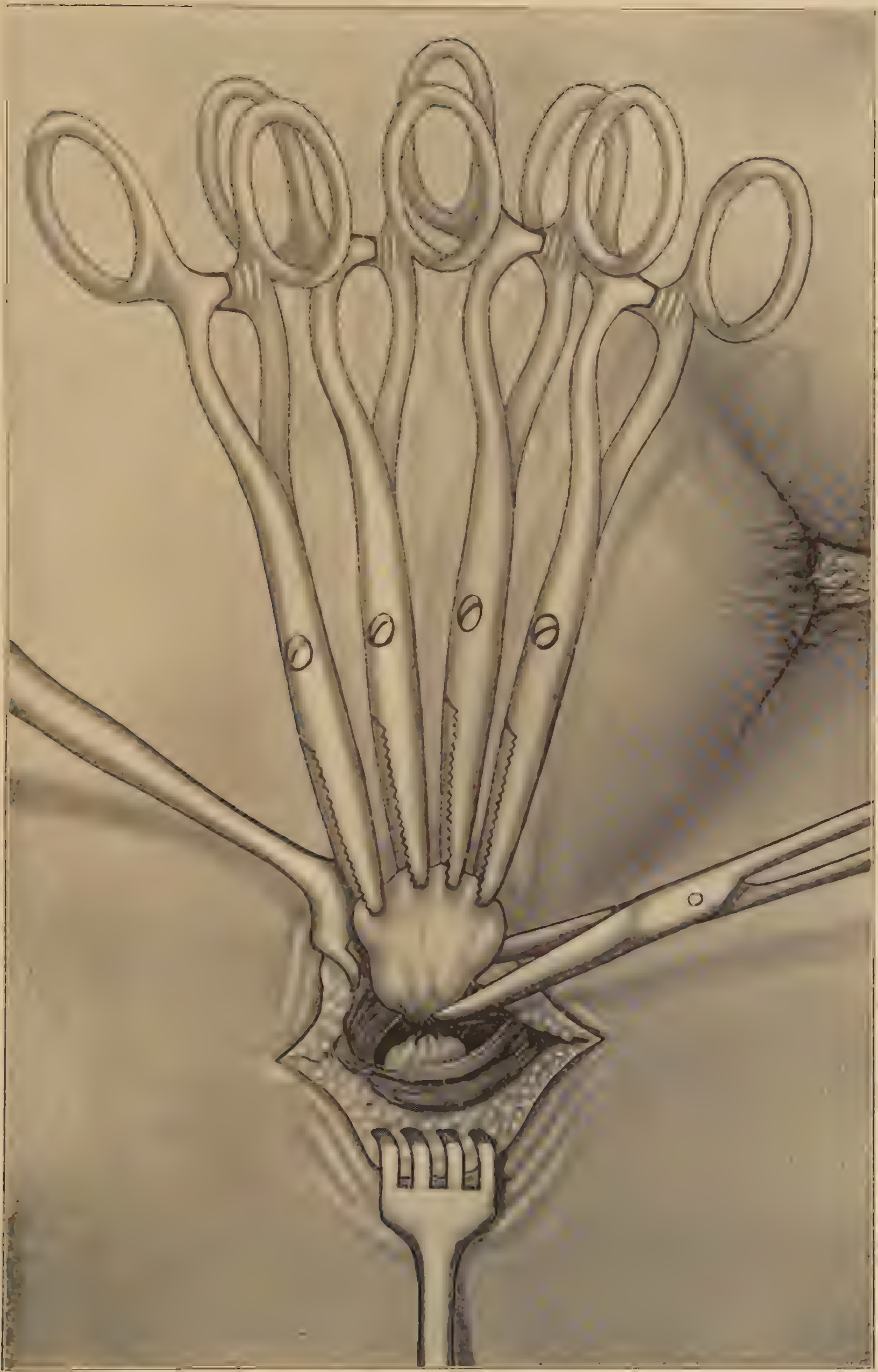


PLATE VI

FEMORAL HERNIA.

Represents a femoral hernia, the entire sac having been dissected free to a point within the femoral ring, then transfixed and ligated, the sac being drawn out of the wound with forceps, the scissors being in position to cut away the sac beyond the ligature.

of its smooth peritoneal lining and usually there is an escape of hernial fluid as soon as the sac is incised.

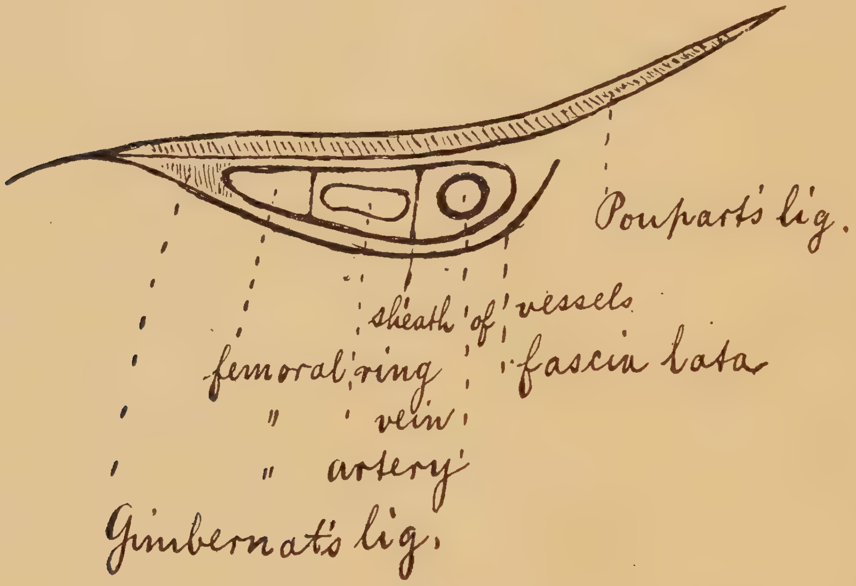
If the sac is recognized before opening it should be carefully separated from the surrounding tissues to a point quite within the femoral ring. It should then be opened to determine its contents. If it contains intestines, these should be replaced into the peritoneal cavity; if omentum, it is well to grasp this with forceps and draw it down until a slight amount of resistance indicates the fact that all of that portion which occasionally descended in the hernial sac has been drawn down. If the amount is considerable it should be ligated in a sufficient number of portions to prevent its being tied in a mass large enough to cause irritation by its presence in the abdominal cavity.

The ligatures should consist of catgut or fine silk, which should be applied just tightly enough to control the hæmorrhage, but not sufficient to crush the tissues. It is well to tie three times if catgut is used, because the peritoneal fluid has a tendency to soften this material and cause the knot to loosen. The portion beyond the ligatures is cut away, care being taken to leave enough tissue to prevent slipping. For the same reason great care must be used in replacing the stump.

It is important to dispose of the long, thin portions of omentum in this manner, because if left undisturbed they are likely to become insinuated in any slight depression which may be left in the abdominal wall at the point of the operation and hence predispose to recurrence.

The hernial sac is then grasped by means of hæmostatic forceps and drawn out of the wound as far as possible without tearing it loose, as shown in the accompanying Plate VI. It is then ligated as high up as possible with catgut or fine silk. It is best to transfix the neck of the sac with the ligature mounted upon a needle, and to tie first to one side and then to the other in order to prevent slipping of the ligature when the pedicle is dropped. A sufficient portion of the sac should be left outside of the ligature to prevent slipping, as shown in the accompanying figure.

When the sac has been cut away the stump will retract within the peritoneal cavity and the ring will be left without a lining.



If the cavity formed by the removal of the sac contains masses of fat, these should be removed. This can be accomplished in a moment by grasping these masses with a piece of moist gauze. The fat seems to cling to the rough gauze, while the other structures slip through your grasp. A perfectly clean dissection can be made in this way in a few minutes without harm to blood-vessels and nerves, which would require a considerable time if made with dissecting forceps and scalpel.

This virtually completes the operation with the exception of a row of superficial sutures closing the skin.

If one observes the anatomical conditions present, as shown in the diagram, it is plain that any attempt at closing the femoral canal after the hernial sac has been removed, must to some extent favor the production of a recurrence, because this canal is almost a perfect ring in most cases.

It is a well-known fact that it is practically impossible to keep any ring in the human body open unless it is lined with mucous membrane, or with a serous membrane containing fluid; consequently the most certain method of closing this ring consists in removing the serous membrane by removing the hernial sac to a point within the abdominal cavity and permitting the ring to close spontaneously. After applying this plan to a large number of femoral herniæ I am convinced that it is quite as impossible to keep this ring open, unless it is distorted by one of the many methods which have been devised for its closure, as it is to keep any other ring or canal, not lined with serous or mucous membrane, open. In other words, all of the methods which have been devised for closing this ring are more or less harmful and tend to cause a certain number of recurrences. Of course, if the ring has been injured during the reduction of a strangulated hernia, which could not be accomplished without cutting the ring, then this injury must be repaired in order to restore the original favorable conditions.

In case of femoral hernia due to a severe traumatism, especially if this consisted of a violent blow upon this portion of the body, Poupart's ligament is occasionally separated for some distance from its attachment and then the femoral opening may not be a perfect ring, but a broad gap. In these cases it is occasionally wise to freshen the edges of this irregular opening and to construct, as nearly as possible, a perfect ring. There is, however, only a very small proportion of cases in which this is necessary. Indeed it seems as though the tissues forming the femoral ring were increased in amount to quite a marked extent by the irritation due to the presence of the hernia, and when once deprived of its serous lining by the removal of the hernial sac this ring contracts and closes with astonishing rapidity.

Preparatory Treatment.—In all these patients it is best, if possible, to institute systematic treatment for a month or two before performing the operation, with a view to reduce the obesity.

After-Treatment.—It is important to prevent for a short time the protrusion of the peritoneum into the femoral ring in order to secure for this part the best possible conditions for contracting and closing permanently. This condition can be favored in two ways: first, by reducing the intra-abdominal pressure, and, second, by keeping the contents of the abdominal cavity from approaching the seat of the operation.

Abnormal intra-abdominal pressure may be continuous as a result of the accumulation of gas in the alimentary canal, or as a result of obesity; or it may be intermittent, as in case of vomiting or coughing, or if the patient suffers from constipation and has to employ an abnormal amount of intra-abdominal pressure during the evacuation of the bowels. Very rarely there is a form of continuous intra-abdominal pressure affecting herniæ in case of ascites.

The intestines and the omentum can be kept away from the region of the operation by elevating the foot of the bed six or eight inches during the first week following the operation, at the end of which time the femoral ring will have contracted sufficiently to prevent any protrusion. This posture, however, is not safe for patients who are advanced in age, because in them it is likely to cause a hypostatic congestion of the lungs, which may result in pneumonia.

The abdominal pressure due to constipation can, of course, be readily relieved and should be relieved, not only for the time immediately following the operation, but the patient should understand the importance of remaining perfectly free from this source of trouble. This will also in a great measure remove another important cause of abnormal intra-abdominal pressure, that due to gaseous distention of the stomach and intestines. This condition can be overcome readily for the time immediately following the operation by having the alimentary canal thoroughly evacuated on the day before by the free use of a cathartic, preferably by the administration of two ounces of castor oil in the foam of beer or malt, and the use of enemata and the prohibition of any form of food which is likely to produce gas.

During the first and second days after operation the patient is given hot water flavored with a little beef extract, if this is desired by the patient, then some prepared, predigested food is given every three hours for a few days, then milk and lime water, then soup, and after ten days or two weeks a light diet is allowed.

Aside from the immediate benefit to the patient there is the further advantage in this plan of feeding that the patient's digestive organs are given an opportunity to rest and recuperate from the results of their abuse, which have usually been long-continued and vigorous.

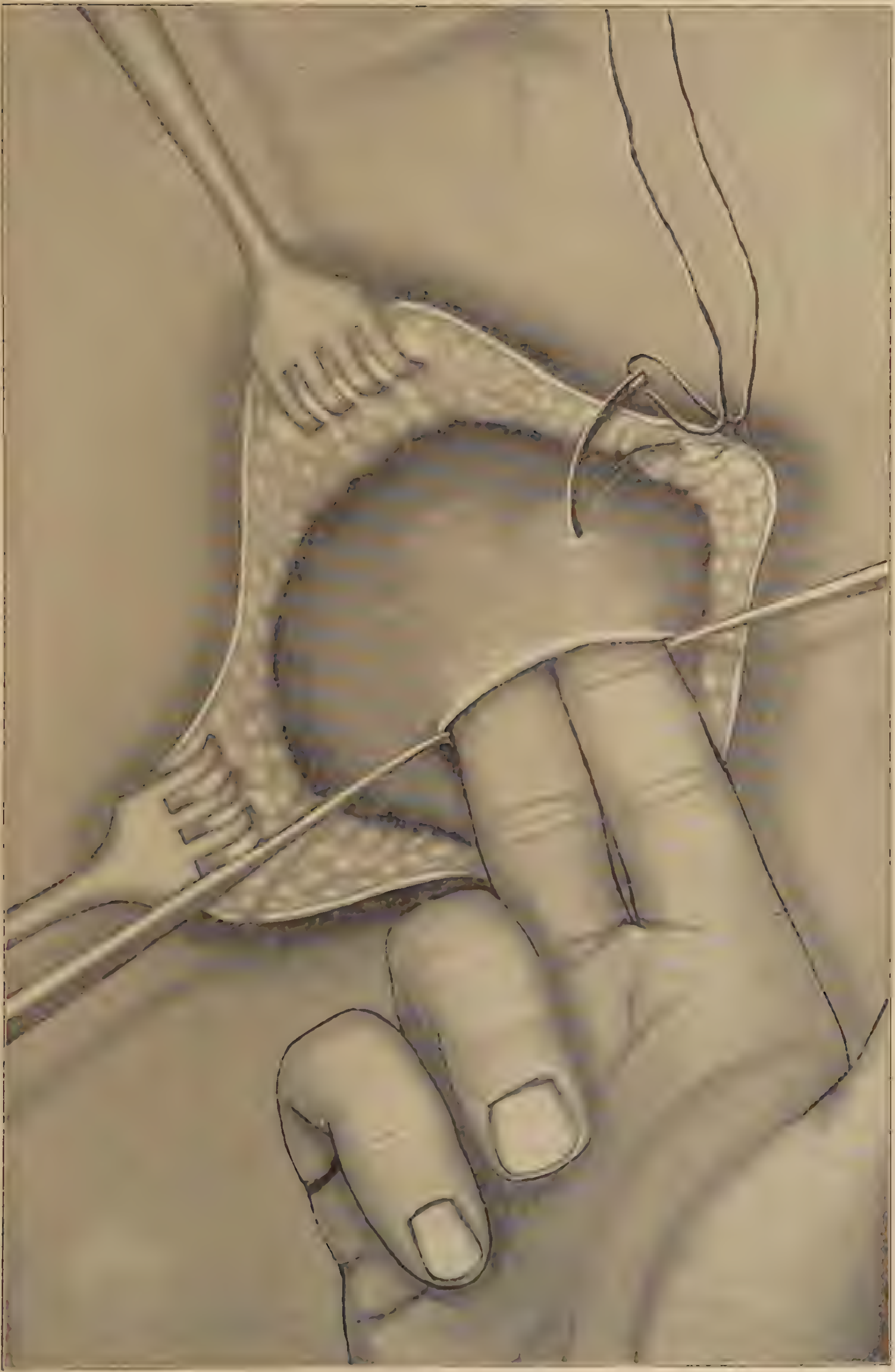


PLATE VII.

UMBILICAL HERNIA.

Represents the hernial ring in an umbilical hernia laid bare, with the tissues dissected back down to the aponeurosis. Two fingers of one hand are inserted into the abdominal cavity in order to protect the intra-abdominal organs against injury from the needle, which is inserted one and one-half to two inches from the edge of the ring. A blunt hook is inserted on either side to stretch the ring transversely.

UMBILICAL HERNIA.

The patient before us is forty-nine years of age, a housewife, whose history was of no medical importance until nineteen years ago. At that time, during an attack of whooping cough, the patient noticed a slight bulging in the region of the umbilicus. Six months later during the birth of her fourth and last child this condition became considerably worse. It continued to develop slowly until ten years ago, when it was suddenly increased on account of a fall. Patient has suffered from mild melancholia for three years.

PRESENT CONDITION.—Obese patient; pulse and temperature, heart, lungs and kidneys normal; bowels constipated, tongue coated. Abdominal walls very thick. A protrusion is noticed at the umbilicus, the size of a small fist, covered with very thin skin. The mass cannot be reduced into the peritoneal cavity and is very tender upon pressure. There is also tenderness upon pressure in the right inguinal region.

DIAGNOSIS.—The condition present in this patient can give rise to but one diagnosis—umbilical hernia.

ÆTIOLOGY.—This hernia was brought about in the usual manner and under the usual conditions. The abdominal wall of the patient had suffered from the effects of three pregnancies; it had been weakened by an abnormal amount of fat; then it was taxed beyond its strength by the increased intra-abdominal pressure caused by the whooping cough. To this was added another pregnancy and later a fall. Each of these conditions favored the further weakening of the abdominal wall and the increase of the hernial protrusion.

In childhood a hernia in this position will heal spontaneously in almost every case, provided the increased intra-abdominal pressure is eliminated, because the opening is a perfect ring composed of tissue which has the tendency to contract. It is quite different in patients over thirty years of age. The increasing obesity primarily overcomes the tendency of the tissues forming the ring to contract; moreover, the abdomen broadens, while the distance between the sternum and the pubis decreases; hence the ring is distorted, which again interferes with its closure.

Again, the omentum which has been forced into the hernial sac forms inflammatory adhesions and this permanently prevents the closing of the ring.

Treatment.—Were the hernia reducible there might be a choice between palliative measures consisting in the fitting of a truss and radical measures consisting in an operation for the permanent cure of this hernia. We have consequently the choice between giving this patient an abdominal bandage with a pouch-like arrangement in which to carry her hernia, and performing an operation.

Indications for Operation.—The patient is virtually disabled for performing her household duties because there is a constant dragging feeling in the region of the umbilicus due to the adhesion of the omentum. For the same reason she is unable to walk, and as a result of this she is compelled to lead a sedentary life, which causes her obesity to increase. There is a kind of vicious circle established. The increase in the hernia prevents her from exercising sufficiently to reduce her obesity and this in turn favors the increase in the hernia. Unless she is relieved of her hernia she will become more and more helpless.

Preparatory Treatment.—The patient has come to the city from a distance and is compelled, on account of her financial circumstances, to return home as soon as possible. It is also impossible for her to return to her home and come to the hospital later for her operation. Were it not for these circumstances, it would be much better to first place her under treatment for the reduction of her obesity. The same plan would be followed which has already been described in connection with femoral hernia. This not being possible we have reduced the intra-abdominal pressure as much as possible by the use of saline cathartics and placing the patient upon a diet of beef-tea for a few days, also giving her hot baths followed by cold showers and massage.

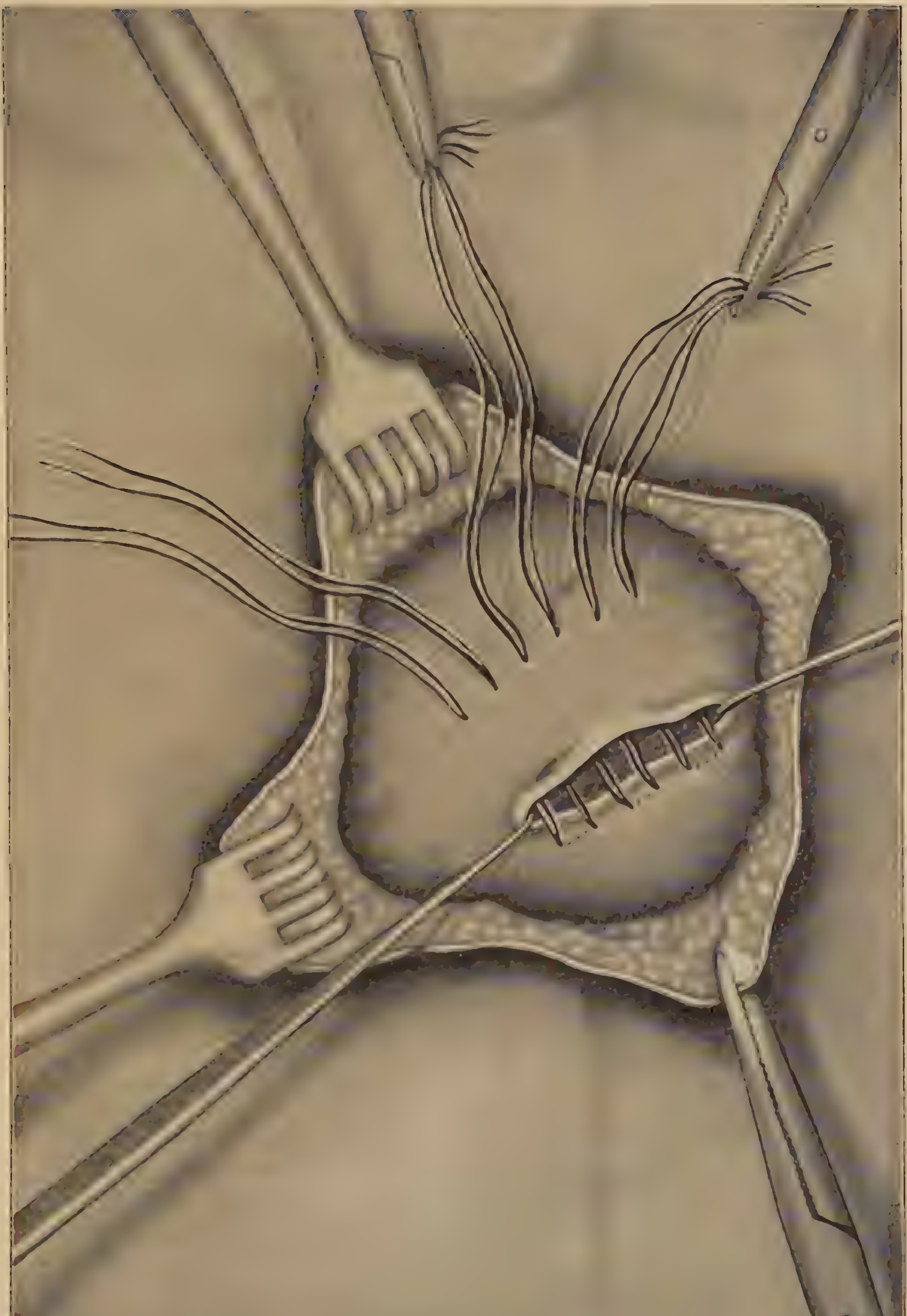


PLATE VIII.

UMBILICAL HERNIA

Represents three chromicized cat-gut stitches in position. The cat-gut is represented double. This is not important, but has the advantage of extra security in case there should be a defect in one strand, besides making it possible to use a smaller size of cat-gut.

Of all herniæ this form has been most difficult to treat surgically and has given a larger percentage of recurrences than any other. This condition has, however, changed since the introduction of Mayo's operation some seven years ago, which has made the results in this form of herniotomy quite as satisfactory as in inguinal hernia.

The operation comprises the following steps:

(1) "Transverse elliptical incisions are made surrounding the umbilicus and hernia; deepened to the base of the hernial protrusion.

(2) The surfaces of the aponeurotic structures are carefully cleared an inch and a half in all directions from the neck of the sac.

(3) The fibrous and peritoneal coverings of the hernia are divided in a circular manner at the neck, exposing its contents. If intestinal viscera are present the adhesions are separated and restitution made. The contained omentum is ligated and removed with the entire sac of the hernia.

(4) With forceps the margins of the ring are grasped and approximated. Whichever way the overlapping is more easy of accomplishment, suggests the direction of the closure. The illustrations show the overlapping as done from above downward.

(5) For this approximation an incision is made through the aponeurotic and peritoneal structures of the ring extending one inch or more transversely to each side, and the peritoneum is separated from the under surface of the upper of the two flaps thus formed.

(6) Beginning from one to one and one-half inches above the margin of the upper flap, three to four silver-wire mattress sutures are introduced, the loop firmly grasping the upper margin of the lower flap; sufficient traction is made on these sutures to enable peritoneal approximation with running sutures of catgut. The mattress sutures are then drawn into position, sliding the entire lower flap into the pocket previously formed between the aponeurosis and the peritoneum above.

(7) The free margin of the upper flap is fixed by catgut sutures to the surface of the aponeurosis below, and the superficial incision closed in the usual manner. The lateral approximation is carried out by sliding one side under the other in the same manner.

In the larger herniæ the incision through the fibrous covering of the sac may be made somewhat above the base, thereby increasing the amount of tissue to be used in the overlapping process."

I have employed chromicized catgut sutures in place of the silver wire sutures in all cases I have operated by Mayo's method. I have been called upon so frequently to remove silver wire sutures which other surgeons had employed in various operations that I have abandoned their use entirely and have found that chromicized catgut has all of the good qualities and none of the bad ones of silver wire.

Plate VII shows the manner in which the stitches are introduced, the fingers protecting the intra-abdominal structures against injury from the needle.

Plate VIII shows the deep stitches in place, which when tied will slide one edge of the ring underneath the other. The line of sutures should extend transversely across the body instead of obliquely, as pictured by the artist. In all of my cases I have found it possible to close the opening without tension by placing the line of sutures in this direction.

In small herniæ three deep and about five superficial sutures will suffice, but the number may be increased according to the size of the opening.

Plate IX shows the manner in which the overlapping edge of the hernial opening is sutured to the aponeurosis.

By this method we obtain a double layer of the strong aponeurosis composed of the fascia of the external and internal oblique abdominal muscles together with the transversalis fascia.

In all of these patients I have observed the fact that they have a sense of security and strength after this operation which none of my patients had after operations for the relief of large umbilical hernia by other methods.

Important Points.—Having dissected out the entire hernial sac, together with its overlying thin skin down to the edge of the aponeurosis forming the hernial ring, we must plan to open the sac and dispose of its contents.

There are two areas in which the omentum is usually adherent to the sac, one opposite the most superficial portion, the other along the edge of the hernial ring.

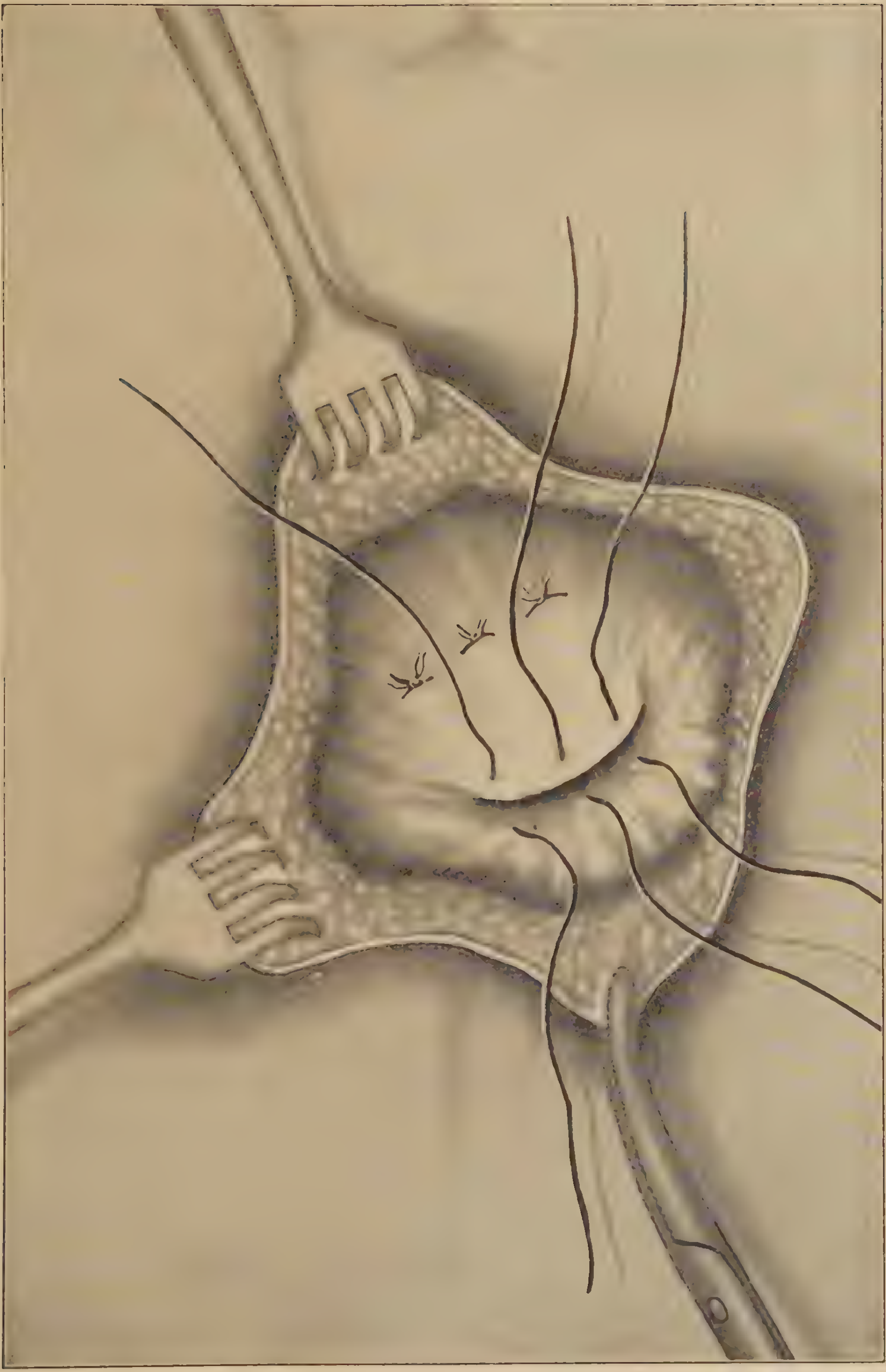


PLATE IX

UMBILICAL HERNIA.

Represents the deep stitches tied, carrying the lower edge of the wound underneath the upper one, with the stitches inserted, which will serve to unite the upper edge of the ring to the aponeurosis of the abdominal wall below.

If we attempt to open the sac opposite either of these points we will find an exceedingly tedious and unsatisfactory task. It is quite different if we open the sac on one side half-way between these two points, where the surfaces are usually free from adhesions. It is then best to begin at one point and systematically loosen the adhesions between the omentum and the hernial ring until the former is entirely free. If this is done the entire task can be accomplished in a few minutes, but if one loosens small areas here and there in an unsystematic manner, a great amount of time may be unnecessarily consumed to the detriment of the patient.

Should the sac contain intestines still greater care must be employed for fear of causing a perforation. Should there be an abrasion on the surface of the intestine this should be covered at once with a few Lembert sutures.

Having loosened all of the adhesions between the omentum and the hernial ring, it becomes necessary to dispose of the mass of omentum. The latter is usually so matted together that it would undoubtedly give rise to great discomfort from pressure were it to be returned to the abdominal cavity; it is consequently best to ligate it in a number of portions, to cut away the part that has been matted together, and to return the remaining portion into the abdominal cavity. At this point it is important to observe care not to place the ligatures too near the transverse colon for fear of causing necrosis.

Prognosis.—If this plan of treatment is followed the prognosis in these cases is astonishingly good, both as regards immediate and permanent results.

After Treatment.—It is well to avoid all abnormal intra-abdominal pressure (1) by reducing the obesity by means of diet and vigorous exercise, preferably walking; (2) by avoiding constipation; (3) by regulating the diet so as to avoid gaseous distention; (4) in the male by avoiding obstruction of the urethra, or correcting this should it exist.

Occasionally one will find a small umbilical hernia in a patient to be operated for some other intra-abdominal condition, like tumors of the pelvic organs, or appendicitis or gall stones.

If the incision in this operation is to be in the median line it is best to extend it above the umbilicus a distance of one or two inches, to excise the umbilicus entirely, to split the fascia of the recti muscles toward the median line and then to close the abdominal wound throughout as though there had been no hernia.

If the operation is for the removal of the appendix or gall stones it is well to make the incision through the right rectus abdominis muscle, then the inner edge of the abdominal wall can be everted. If there is adherent omentum in the hernial sac this can be peeled out and then a purse-string suture of chromicized catgut is passed around the hernial ring with a short curved needle just outside of the abdominal wall and tied just tightly enough to hold the edges in apposition. A second similar stitch is applied just within the abdominal wall and tied in the same manner.

This can be done very easily except in patients with an unusually thick abdominal wall. The method is, however, applicable only to herniæ of moderate size.

VENTRAL HERNIA FOLLOWING ABDOMINAL SURGERY.

This patient, an unmarried woman twenty-two years of age, an office girl by occupation, gives the following history: Uneventful life until age of eighteen, when she had an acute attack of appendicitis, which subsided under treatment but recurred every few months. Two years ago she had an operation for the relief of this condition at the end of an acute attack. The wound suppurated and healed in time by granulation. The patient has been free from acute pain since that time, but has suffered from severe gaseous distention of the abdomen, from digestive disturbances and from constipation. The scar began to broaden soon after the patient returned to her work and shortly afterwards she noticed a distinct bulging of the abdominal wall at the point of the scar. This portion of the abdominal wall has become constantly thinner and the bulging has increased.

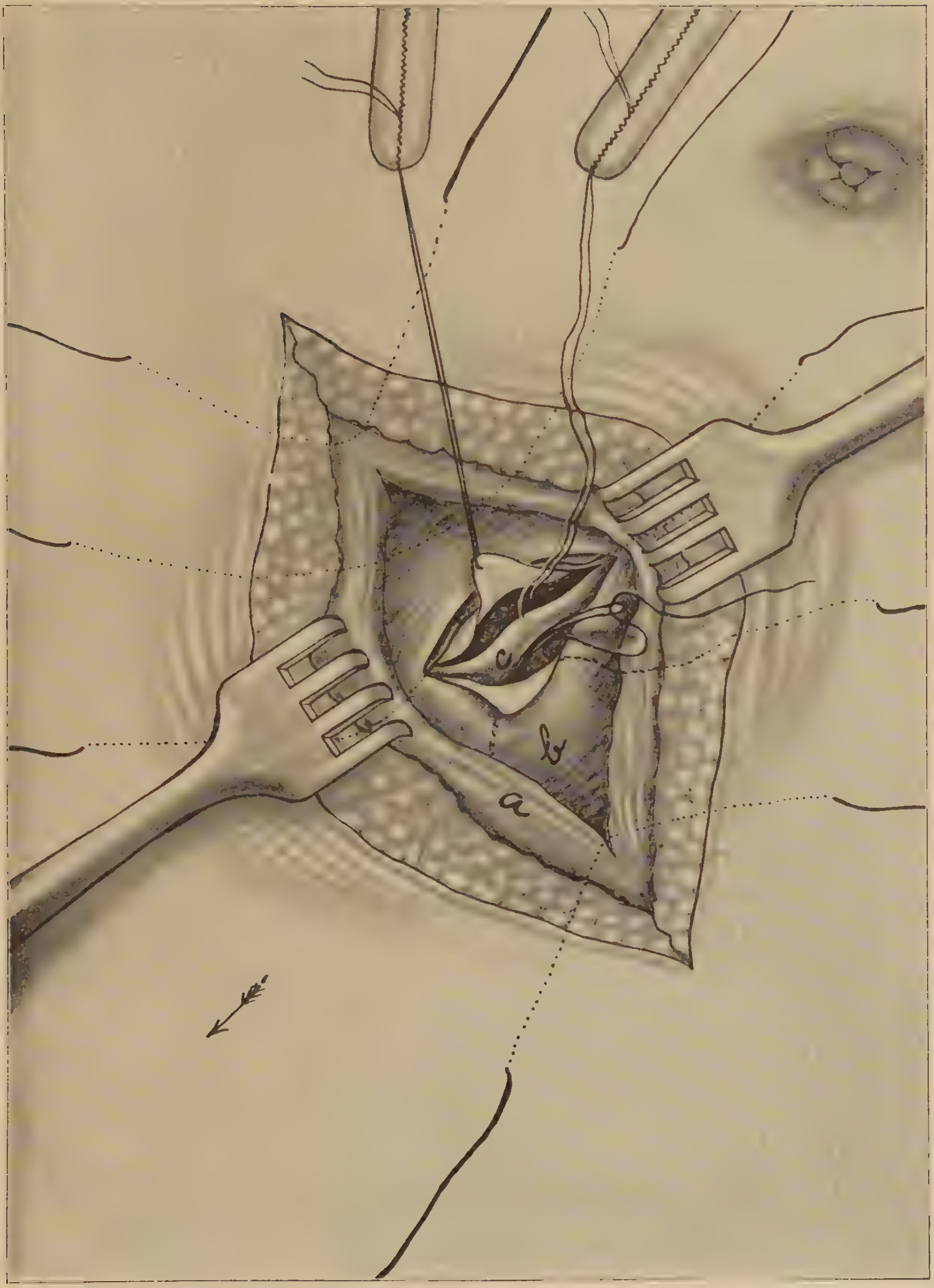


PLATE X.
McBurney's Incision.

Represents McBurney's incision, which extends parallel with the fibres of the external oblique abdominal muscle, (a) separating its fibres without cutting them, then separating the fibres of the internal oblique muscle, (b) again without cutting its fibres and extending through the transversalis fascia and peritoneum (c) in the same direction.

PRESENT CONDITION.—There is a scar ten centimeters in length and five centimeters wide, extending parallel with Poupart's ligament about half-way between the anterior superior spine of the ilium and the umbilicus. The tissue is so thin that the motion of the intestines can readily be distinguished through it. Upon pressing the fingers through this tissue one can readily feel a definite ledge composed of the abdominal muscles on either side, and the intestines can be readily felt behind this thin structure. There is a strong impulse upon coughing. The scar is very tender upon pressure.

DIAGNOSIS.—The condition is so clear that there can be but one diagnosis: Ventral hernia following abdominal section.

ÆTIOLOGY.—In this instance there had been an abdominal section for the removal of the appendix. The incision had been made parallel with the fibers of the external oblique abdominal muscle, then it had been carried through the internal oblique abdominal muscle and the transversalis fascia and peritoneum.

All of these layers had been united after the operation, but the suppuration which followed prevented primary union and consequently there was a union between the edges of all the layers involved on each side of the line of incision and the edges thus formed were united by a mass of cicatricial tissue. This tissue is the least stable of all tissues and consequently it began to stretch very soon after the patient left her bed, becoming more and more thinned out from day to day and permitting the intra-abdominal organs to protrude, forming a ventral hernia.

There is another condition in this case which favored the formation of a ventral hernia. The incision was parallel with the fibers of the external oblique abdominal muscle and consequently none of the fibers of this muscle had to be severed, as they were simply split longitudinally. Had the internal oblique abdominal muscle been split also, as shown in Plate X, the two edges would have been drawn closely together as a result of their own contraction, and the lines of incision through the two muscular layers, being at right angles to each other, a hernia would not have occurred, even though the wound had not united primarily.

In this case the conditions were quite different, the fibers of the internal oblique abdominal muscle being cut at right angles, the edges of the wound were drawn farther and farther apart with each contraction of this muscle as soon as primary union of the cut ends became impossible on account of suppuration. Moreover, these ends became adherent to the edges of the wound in the external oblique abdominal muscle and overcame the tendency these edges naturally show to remain parallel and in close apposition.

INDICATIONS FOR OPERATION.—In most cases of ventral hernia following abdominal section there is no definite ring, the opening being wide; there is consequently no danger from strangulation. There is, however, the constant feeling of insecurity and weakness in the abdominal wall which prevents the patient from performing the duties, or indulging in the pastimes, of persons in health, and as the tissues become thinner and thinner, there is really some risk of having the tissues give way entirely.

Moreover, the digestive disturbances of which this patient complains of are due partly to the fact that there are usually adhesions in these cases between the intestines and omentum and the scar which interfere with the passage of food and gases through the portion of the alimentary canal thus impaired.

When the protrusion is so great as in this case, and cannot be comfortably retained by means of a bandage, there is a sufficient amount of mechanical obstruction to the intestines from their crowding into this pouch to account for the digestive disturbances. For these reasons it seems wise to advise operative treatment, especially in young patients.

OPERATION.—We will first make an incision surrounding all of the scar tissue, because this is of no value in securing a permanent cure of the hernia and its removal is of value from a cosmetic standpoint.

In these herniæ, as in umbilical herniæ, the adhesions of omen-

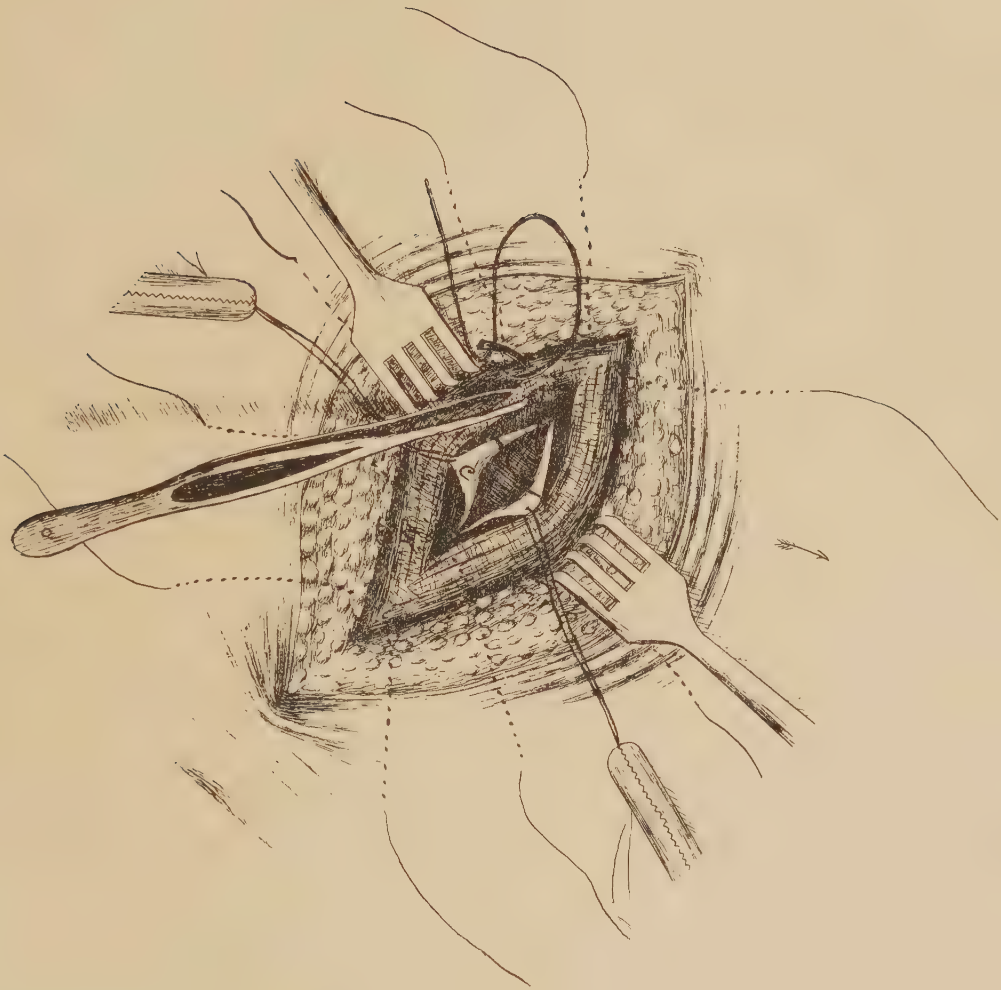


PLATE XI.

Ventral Hernia Following Appendicitis Operation.

Represents an incision through all the tissues of the abdominal wall parallel with Poupart's ligament, separating the fibres of the external oblique abdominal muscle, (a) but cutting the fibres of the internal oblique abdominal muscle (b) at right angles and extending through the transversalis fascia and peritoneum (c) in the same direction.

The internal oblique abdominal muscle (b) is by far the thickest layer.

tum or intestine are likely to be to the most prominent portion of the hernial protrusion or to the edge of the hernial ring, which in these cases is so large as scarcely to deserve this name, or to both of these portions.

The operation is greatly facilitated by making the incision through the peritoneum at a point where there are no adhesions. This can usually be accomplished by choosing a location half-way between the two points just mentioned.

A further aid is found in lifting up the tissues with two dissecting forceps, one in the hand of an assistant, the other in the surgeon's hand, and cutting between these.

As soon as the peritoneal cavity has been opened, all adhesions are carefully separated in a systematic manner. In case abrasion occurs upon the serous surface of an intestine this is at once covered with one or more Lembert stitches. In case the omentum is matted together or appears in irregular bunches or strands these are ligated and cut away. Then the intestines and omentum are replaced into the abdominal cavity and covered with a broad pad of sterilized gauze, moistened with warm normal salt solution.

It now becomes necessary to make a careful dissection of the edges of the wound, in order to lay bare each one of the layers of tissue. This is possible even in cases in which the hernia has existed for a number of years.

We first come to the edges of the incision in the external oblique abdominal muscle and its fascia, then we encounter the fibers of the internal oblique abdominal muscle, cut at right angles and greatly retracted, and lastly upon the transversalis fascia and peritoneum combined. All of these layers are shown in Plate XI. We have found that a hernia in which all the layers have been carefully dissected out in this manner can be closed with the same degree of certainty, as regards permanency of cure, as an ordinary laparotomy wound.

A row of silkworm gut sutures is now inserted, but not tied, as shown in Plate XI. The stitches are placed about three-fourths of an inch apart and grasp each layer down to, but not through, the peritoneum. In this case we will take especial care to draw the internal oblique abdominal muscle forward, as shown in Plate

XI, with dissecting forceps in order to secure a deep bite. Each layer is then sutured separately with a continuous catgut suture. For this purpose I prefer to utilize fine chromicized catgut, No. 1, threaded double. This gives the suture the same strength as a heavier catgut used single and has the advantage that it does not twist nor become unthreaded, and, theoretically at least, it offers more favorable conditions for absorption when it has accomplished its purpose.

After each layer has been sutured carefully, the silkworm gut sutures are tied over all. I believe that it is most important never to draw any of these stitches too tightly for fear of causing pressure necrosis.

A narrow pad of sterile gauze is laid upon the wound and then the abdominal wall is supported with two straps of rubber adhesive plaster, at least two inches wide, in order to relieve the tension upon the sutures.

It does not matter in what portion of the abdominal wall the ventral hernia following an abdominal section may occur, the principles employed in its closure are always the same. The cicatricial tissue is carefully excised, the different anatomical layers are dissected out and then united with deep silkworm gut sutures while each layer is united separately with buried sutures of chromicized catgut which may be applied in continued or interrupted form.

As most of these hernia occur either after appendicitis operations in the right inguinal region, or in the median line between the umbilicus and the pubis, I will also illustrate the operation in the latter variety.

In this position our dissection must expose the deep fascia composed of the aponeurosis of the external and internal oblique abdominal muscles, the rectus abdominis muscle on either side and the transversalis fascia and peritoneum which are closely united.

In Plate XII these layers are shown, the silkworm gut stitches being in place but not tied. The peritoneum and transversalis fascia have been united by means of a continuous catgut suture passing over the silkworm gut sutures so that the latter when tied will bring up the peritoneum and thus prevent the formation of dead spaces between this and the posterior surface of the recti-muscles.

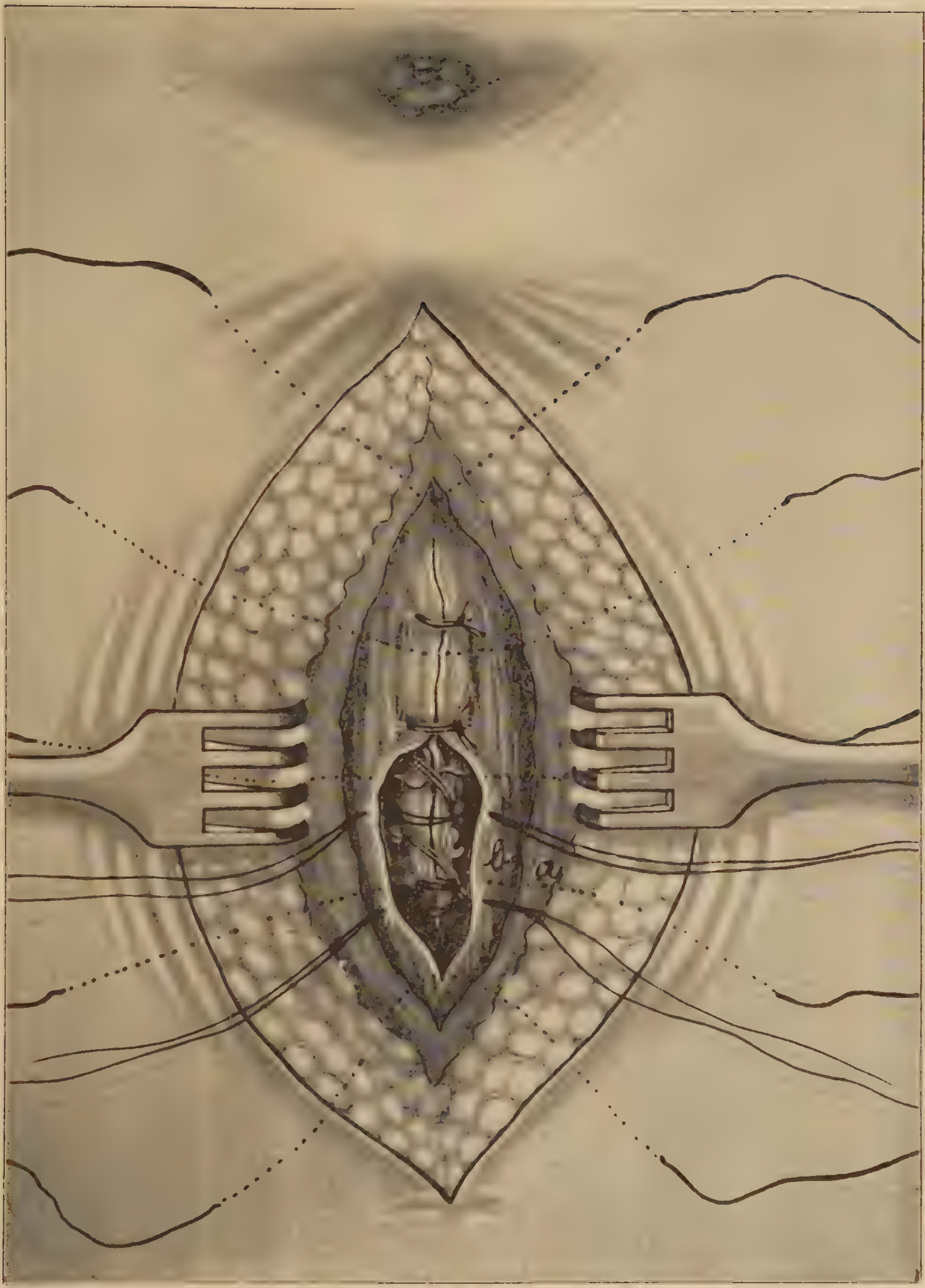


PLATE XII

Closure of Abdominal Wound.

Represents the manner of applying sutures in closing an abdominal incision in the median line; (a) representing the deep strong fascia composed of the aponeurosis of the external oblique abdominal muscles; (b) the rectus abdominis muscle, and (c) the transversalis fascia and peritoneum.

The interrupted stitches have been passed through the recti-muscles in the upper part of the wound and tied and two others have been inserted in the lower part of the wound and left untied in order to show the deeper stitches.

The deep fascia, composed of the aponeurosis of the internal and external oblique abdominal muscle, which is the most important layer, will be carefully sutured over this, as shown in Plate XIII, and then the deep silkworm gut sutures will be tied and a row of superficial sutures applied for coaptation of the skin, as shown in Plate XIV.

A similar dressing will be applied as described above and the abdominal walls will be supported with rubber adhesive plaster as before.

HERNIA OF THE LINEA ALBA.

The patient before us, a gardener by occupation, forty-six years of age, gives the following history: He has always been in good health, with the exception of having had an attack of mountain fever lasting ten weeks, from which he suffered twenty years ago.

He does not remember having suffered any injury, but he has had a number of periods of intoxication lasting for several days at a time, during which he might easily have sustained some injury without knowing it.

Six years ago he noticed a small swelling in the median line half-way between the end of the sternum and the umbilicus. This has increased steadily until it has attained the size of a hen's egg. Usually the patient has simply a feeling of weight in this swelling, but occasionally it is quite painful for several days. There is a slight decrease in the size of the swelling at night and a slight increase when working hard.

PRESENT CONDITION.—Patient is well nourished, thoracic and abdominal organs normal, appetite good, bowels constipated. Two inches above the umbilicus, in the median line, there is a swelling as large as a hen's egg, not painful on pressure, semi-fluctuating, no impulse upon coughing, not reducible upon pressure. In all other respects the physical examination has resulted negatively.

Diagnosis.—Judging from the consistency of the tumor, from its oval, slightly lobulated form, and its subcutaneous location, it is likely that it is composed of fatty tissue. It may consequently be a lipoma. Were there a history of traumatism immediately preceding its appearance, or were there an impulse upon coughing, we could make a positive diagnosis of a hernia of the linea alba.

Differential Diagnosis.—There are certain peculiarities in this case which point distinctly to the latter diagnosis:

(1) There has been a disturbance of the stomach since the appearance of the swelling, which is due in many cases of hernia of the linea alba to the fact that the adherent omentum interferes with the normal motility of the stomach. The opening in the linea alba is frequently so small that an impulse upon coughing is not possible. This is still further interfered with by the extensive adhesions of the omentum to the hernial sac, which in these cases is frequently not a true sac composed of peritoneum and transversalis fascia, but simply a space in the suptured tissues. This disturbance is sometimes so great that the patient is entirely disabled.

(2) The tumor varies in size, decreasing a little at night and increasing perceptibly upon making severe exertion for a considerable time or upon working very hard. Although there is no impulse upon coughing or straining it seems that more of the tissues of the omentum becomes forced through the small hernial opening when there is long continued abnormal intra-abdominal pressure than when this is normal.

(3) The swelling becomes painful at irregular intervals, especially when the patient attempts to work hard. I have repeatedly seen strong, otherwise perfectly healthy men entirely disabled for work by the pain resulting from a hernia in this region, so small that it had escaped the notice of physicians and surgeons for years, the patient not taking it to be of sufficient importance to require their attention.

(4) The swelling usually appears suddenly after an injury, such as a sharp blow upon the linea alba.

Considering all of these facts it seems likely that this is a hernia of the linea alba, although we cannot be absolutely positive in our diagnosis until the mass has been exposed.

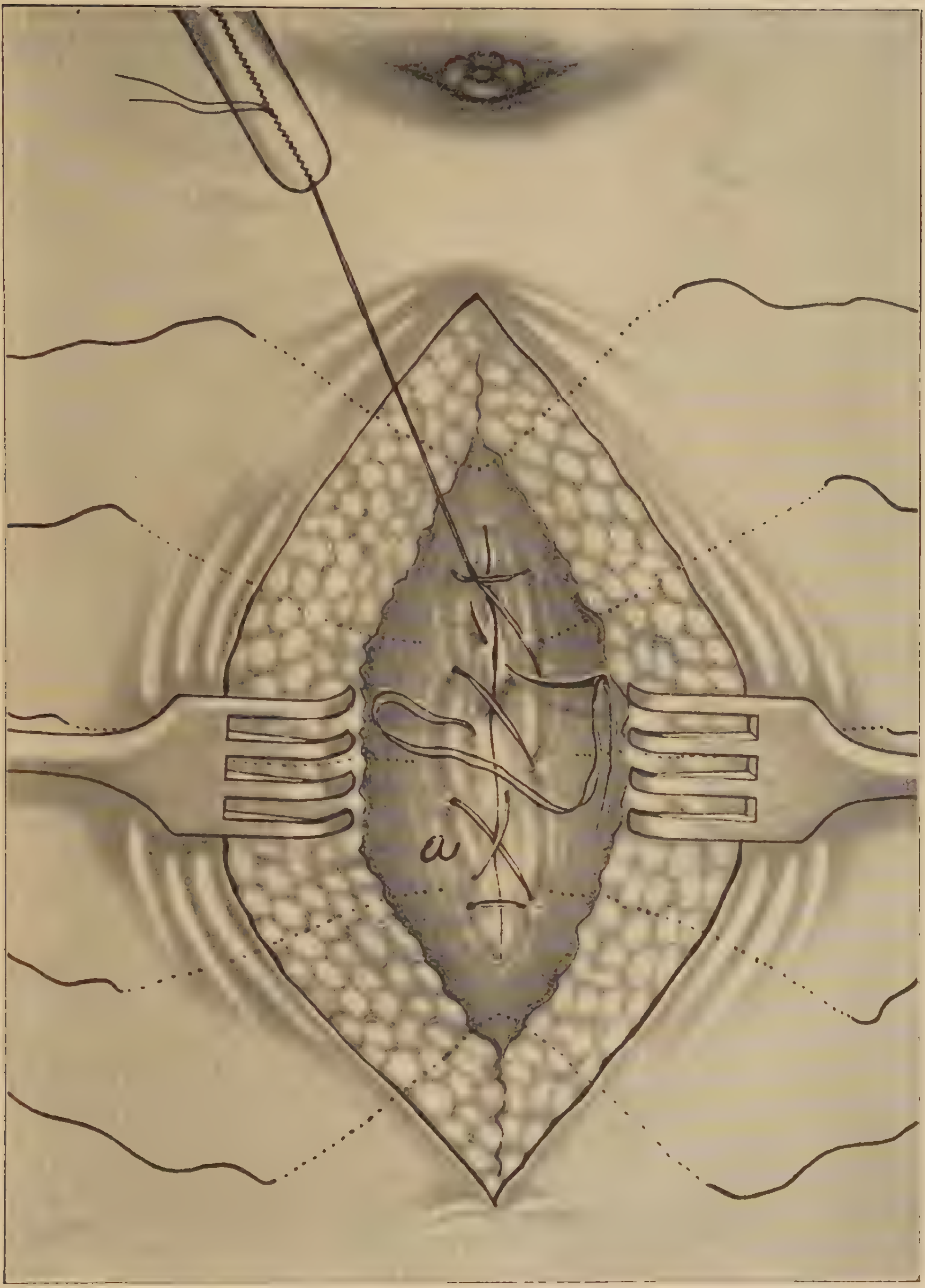


PLATE XIII

Closure of Abdominal Wound.

Represents the abdominal wound in the median line with each layer sutured separately, but the deep silkworm gut sutures still untied; (a) represents the strong deep fascia composed of the aponeurosis of the internal and external oblique abdominal muscles upon which the permanency of the closure and the absence of post-operative hernia depends.

ÆTIOLOGY.—In this case the ætiology is not very clear on account of the fact that it is likely that the patient's powers of observation were greatly impaired at the time at which the condition was produced.

INDICATIONS FOR OPERATION.—The amount of suffering is not sufficient to disable the patient for performing his work, but he suffers from gastric disturbances and from pain in the region of the swelling whenever he labors hard, and the periods of acute irritation are becoming more numerous, and the extent of the irritation more severe constantly. Moreover, the swelling is becoming more and more sensitive to the pressure from the clothing.

Were it possible to reduce this swelling into the abdominal cavity its retention by means of a truss might be considered, but experience has shown that this would not succeed.

The patient is not in any immediate danger, because the opening is too high in the median line to permit the protrusion of a portion of the small intestine, and it is too small to engage either the stomach or the transverse colon. There is consequently no danger of strangulation.

The patient is familiar with all of these facts and has chosen the operation for the purpose of securing relief from pain and to increase his working capacity.

PREPARATORY TREATMENT.—This is the same as in all abdominal sections. Were the patient very obese, we would advise treatment for the relief of this encumbrance.

OPERATION.—A longitudinal incision twelve centimeters in length is made over the most prominent portion of the swelling, through the skin and superficial fascia, which exposes a flattened oval mass as large as a hen's egg. Lifting up the edges of this mass the finger reaches a point in the aponeurosis forming the linea alba which is defective. At this point the latter has a perforation which would admit two fingers were it not occupied by a projection of the fatty swelling which we have exposed. The latter is lobulated, quite vascular and is slightly adherent to the surrounding tissues. It is not surrounded by a true hernial sac. This has consequently come through in the defect in the abdominal wall and we have before us a hernia of the linea alba, and the fatty mass is composed of omentum which has been forced out of the peritoneal cavity through this opening.

It is impossible to replace the omentum into the peritoneal cavity, and if it were it would not be desirable to do so because it has been so completely changed from a thin, delicate, protecting sheet into a clumsy mass, that it would probably give rise to irritation were it replaced.

We will consequently transfix the narrowed portion at the point where it issues from the opening in the aponeurosis with a double catgut ligature, tie it in halves, cut away the mass a sufficient distance outside of the ligature to prevent slipping, and drop the stump into the abdominal cavity.

It frequently happens that the fat contained in a hernia of the linea alba is partly or entirely composed of pre-peritoneal fat instead of omentum. These patients suffer even greater pain than those in which the mass is composed entirely of omentum. When this mass is removed the pedicle is simply reduced through the hernial opening into the preperitoneal space.

The remaining steps of the operation will vary according to the character of the opening. If this is small and circular and if its edges are thick, it is probably quite as unnecessary to do anything toward closing this opening as in femoral hernia. As soon as the ring is empty it will close spontaneously.

If the opening is oblong or triangular in form but not more than two or three centimeters in length with substantial edges, these may be brought together with two or three buried chromicized catgut sutures. If, however, the opening is oblong and its edges thin, as in this case, it is likely there would be a recurrence unless the defect were repaired in a more substantial manner.

In order to secure favorable conditions for a permanent cure in these cases it will be necessary to carefully expose each one of the various layers composing the abdominal wall at this point and then to close this wound precisely in the manenr described in operations for ventral hernia following abdominal section in the median line. The anatomical layers in this portion of the linea alba from without inward are as follows: 1, skin; 2, superficial fascia; 3,

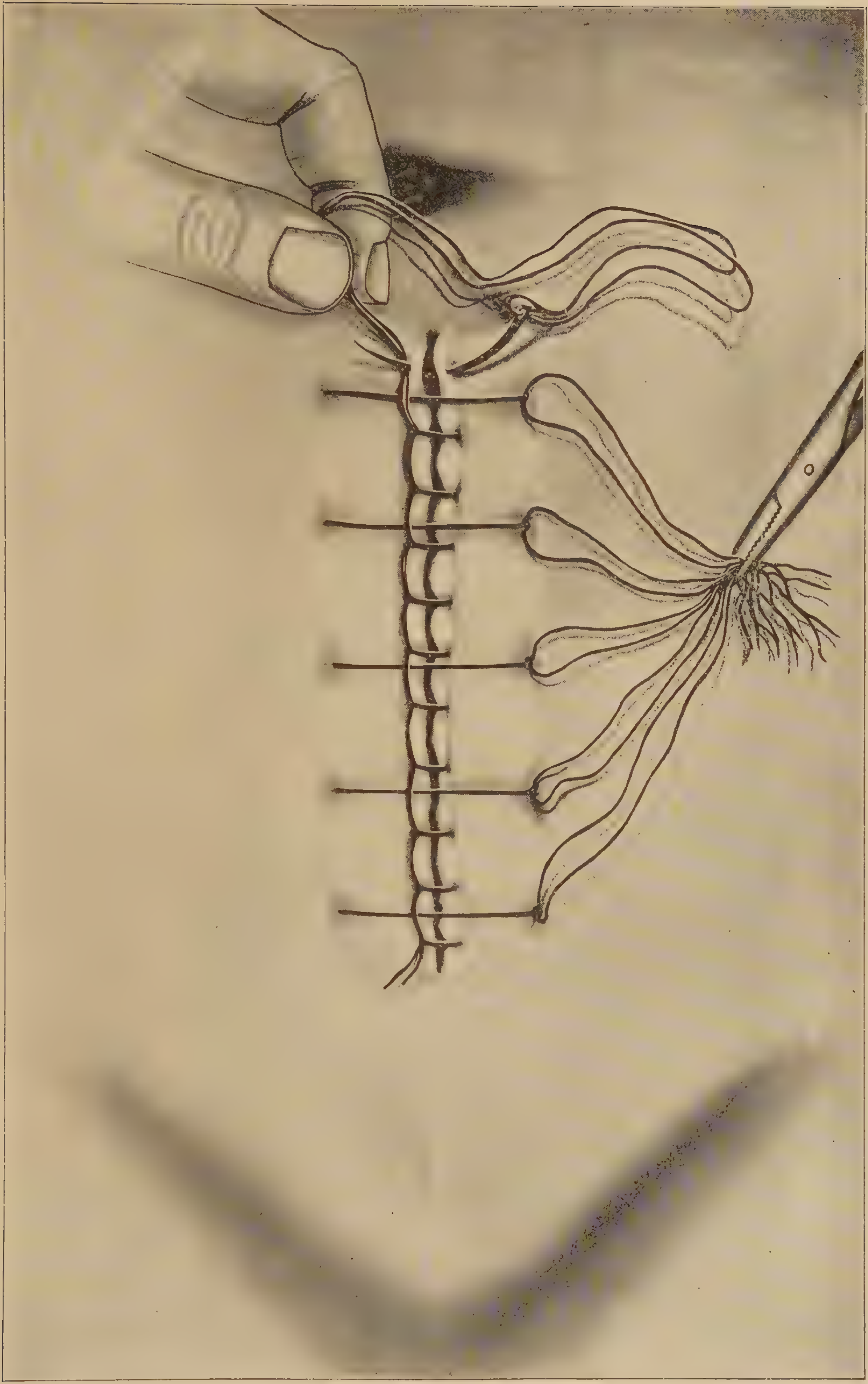


PLATE XIV.

CLOSURE OF ABDOMINAL WOUND.

Represents the deep silkworm gut sutures tied loosely so as to avoid pressure necrosis and a continuous coaptation stitch for the accurate adjustment of the edges of the skin.

fat; 4, strong fascia composed of the aponeurosis of the external oblique abdominal muscle and the outer half of the fascia of the internal oblique; 5, rectus abdominis muscle; 6, the inner half of the fascia of the internal oblique abdominal muscle; 7, the transversalis fascia; 8 peritoneum. The last three layers mentioned are usually so closely united with each other that they apear as one layer.

Having exposed these layers we will close the wound as shown in Plates XII and XIII.

A row of silkworm gut sutures extending through all the layers down to the peritoneum are inserted but not tied. Then the deepest layer composed of peritoneum, transversalis fascia and the inner half of the aponeurosis of the internal oblique abdominal muscle is sutured with a continuous catgut suture.

Now the recti-muscles are brought together by means of just a sufficient number of interrupted catgut sutures to bring them in accurate apposition. The strong, deep fascia, upon which really the permanency of the cure depends, is next carefully sutured with chromicized catgut; and then the deep silkworm gut sutures are tied and, if necessary, a row of coaptation stitches is applied to adjust the edges of the skin.

In connection with this case I wish to direct attention particularly to the diagnosis of these troubles.

They are somewhat rare and almost never diagnosed until they have suffered for many years. In the meantime they usually go from one physician to another, receiving treatment alternately for the relief of gastric disturbances or neurasthenia.

HERNIA IN CHILDREN.

The patient before us, a boy twenty months of age, comes with the following history: He has always been well and strong since birth and none of his functions have been impaired. There is a vague history of a fall two months ago, but nothing definite can be determined in this respect. It is quite likely that the mother imagines this from the fact that she feels compelled to account for the child's condition in some way.

Six months ago the mother noticed a swelling in the region of the left inguinal canal extending into the scrotum on the left side. This swelling decreases in size when the child is in bed, but cannot be reduced while he is awake. The protrusion increases when the child cries. There is an abundance of fat in the subcutaneous tissues and it is difficult to determine whether the mass fluctuates upon palpation. An attempt has been made to apply a truss, but the child screamed incessantly when this was in place, so that it had to be removed directly. The child is otherwise normal, with the exception of having an adherent prepuce.

DIAGNOSIS.—It is often difficult to make a positive diagnosis in a child so young as this one, because it is practically impossible to keep him quiet long enough to determine the conditions present, unless he is anæsthetized.

DIFFERENTIAL DIAGNOSIS.—Hydrocele is the only condition, aside from hernia, which is common in children of this age and causing a swelling in this position. In one case I encountered a lymphangioma, and a congenital lipoma, or one developing shortly after birth, is possible in this location, but so rare that it really need not be considered.

Now that the child is anæsthetized, we find that the swelling can be reduced into the abdominal cavity through the inguinal canal, but as soon as the pressure is released it reappears at once. There is also the sensation to touch of reducing a mass of a definite permanent form, which would not be the case were the swelling composed of omentum or intestine contained in a hernial sac. The condition present must consequently be an irreducible hydrocele of the cord.

ÆTIOLOGY.—In this patient the communication between the peritoneal cavity and the tunica vaginalis evidently remained open after the descent of the testicle and gave rise to a congenital hernia. At some time later the upper end of this hernial sac closed by adhesion of its walls, and then its serous lining, instead of becoming adherent to the tissues of the spermatic cord and bringing about a spontaneous cure, secreted fluid and this caused the distention of this sac. Being located in the inguinal canal the latter cannot close, hence the impulse upon coughing or straining.

Indications for Operation.—So long as the inguinal canal is distended with this pouch filled with fluid it is impossible for it to close and the development of the child cannot proceed normally. The mass cannot be reduced into the peritoneal cavity thus leaving the canal free to close, neither can it be withdrawn downward. It is consequently necessary to resort to some operative measure for the relief of the condition. This can be accomplished by withdrawing the fluid by means of a cannula, but this would probably not secure permanent relief because the serous fluid would re-form unless some irritating substance was injected which would cause a sufficient amount of aseptic inflammation to cause the surfaces to adhere. For this purpose a few drops of ninety-five per cent. solution of carbolic acid has been injected, or a larger quantity of five per cent. solution of the same substance, or a few drops of tincture of iodine. None of these substances are, however, certain to accomplish the end and none of them are entirely harmless. We will consequently choose a method which is not connected with more danger and which will result in a permanent cure.

An incision is made over the most prominent portion of the swelling parallel with the inguinal canal and down to the hernial sac. It is now apparent that the sac is distended with fluid. We will incise it and permit the fluid to escape. We find a smooth sac containing nothing but about thirty cubic centimeters of a clear fluid. The sac is easily separated from the surrounding tissues. At its upper end it is found closed by means of scar tissue which has united its walls. It is withdrawn from the inguinal canal a little further, then transfixed with a needle threaded with catgut and tied. Then the sac is cut away, care being taken to leave a sufficient amount of tissue beyond the ligature to prevent slipping. The stump is permitted to retract within the abdominal cavity. No attempt is made to close the inguinal canal, because this occurs spontaneously in children as soon as the sac is removed. Suturing the skin completes the operation.

Carefully compiled statistics have shown that of all the hernia encountered in the adult less than five per cent. have existed since childhood, and also that of all children under six years of age suffering from hernia seventy-three per cent. will heal spontaneously, without any form of treatment, before the age of thirteen, consequently the relative number of herniæ in children requiring operative treatment must be very small.

Spontaneous cure is accomplished, (1) By the late closure of the inguinal canal, which should have occurred before birth; (2) By the broadening of the pelvis. The parietal peritoneum enlarges at the expense of the mesentery; the latter being thus shortened prevents the entrance of the intestines into the inguinal canal; (3) By the displacement of the internal abdominal ring with the growth of the child; (4) With the growth of the child a number of the predisposing causes are eliminated.

These are:

(a.) *Abnormal Intra-Abdominal Pressure.*—There can be no doubt that the most important direct cause of herniæ in children is an abnormal intra-abdominal pressure. This may be due: 1, To gaseous distention of the stomach and bowels, caused by faulty feeding and consequent indigestion; 2, To great pressure exerted during the act of defecation, on account of constipation; 3, To the same condition due to obstruction on account of phimosis; 4, To severe vomiting; 5, To long-continued coughing. In connection with all of these conditions, it is to be remembered that children suffering from digestive disturbances necessarily suffer much from pain, and the exertion incident to crying will greatly increase the existing abnormal intra-abdominal pressure. In order to quiet the child the mother will nurse it at irregular intervals and this will again increase the digestive disturbances, and this, in turn, the intra-abdominal pressure and pain.

Increased Intra-Abdominal Pressure Due to Coughing.—I have observed cases in which the herniæ healed regularly during the summer months, but reappeared in the autumn as soon as the children acquired coughs, which lasted almost all winter. By the time spring arrived the herniæ had attained considerable size, only to heal again during the summer while the patients were free from coughs. By placing these children in bed and elevating the lower end sufficiently to make an angle of twenty degrees and giving them remedies to relieve the cough, the herniæ disappeared within six weeks. Then advising the mothers to give the children cold baths every day, and to bring them for inspection often enough to keep the condition under control, and giving them codliver oil and malt extract as soon as the cold weather appeared, they went through the next winter without any coughs and consequently without a recurrence of the herniæ. In the same manner children who are suffering from obstruction to the upper air-passages, on account of enlarged tonsils, nasal adenoids or polypi and consequent conditions, will rapidly recover from their herniæ if these conditions are relieved by proper treatment.

(b.) *Increased Pressure Due to Gaseous Distention.*—It is very usual for the children who are brought into the hospitals for the treatment of hernia to have greatly distended abdomens, due to digestive disturbances resulting in gaseous distention of the stomach and intestines. If this occurs in nursing infants the mother should be instructed to nurse the child at regular times. Her own habits and diet should also be regulated. If the child is constipated this condition should be relieved. Aside from this the mother must be instructed never to carry the child, because she will not follow the advice of keeping it in the inverted position and, consequently, will increase the intra-abdominal pressure whenever she picks up the infant. It should sleep in a separate bed with the lower end elevated sufficiently to make an angle with the floor of about twenty or thirty degrees. This will keep the hernial sac empty of intestines and omentum and will very greatly assist in the obliteration of the hernia. If the mother's milk continues to give rise to indigestion, notwithstanding every precaution available for making it wholesome, it is often best to place the child partly or wholly on artificial food at least for a time. Above all things, however, it is important to impress the mother with the necessity of being regular in feeding the child and to again place it in its bed as soon as it has been nourished, or, better still, to lean over the child's bed and nurse it without disturbing its inverted position.

I have repeatedly placed these children in the hospital and sent the mother, who was exhausted from overwork and care of the sick child, home to rest, permitting her to come to the hospital morning, noon and night to nurse the child. After the first day or two the mother becomes rested, her journeys to and from the hospital compel her to be out of doors, and the fact that she is relieved of the care of the child gives her the necessary rest and sleep. In the meantime her milk improves, the child becomes accustomed to lie quietly in bed and to take its nourishment regularly, its digestion improves, the gaseous distention disappears, and with it the abnormal intra-abdominal pressure, which is still further relieved because the child sleeps most of the time and seldom cries. After the child has been in the inverted position for a few days the hernial sac remains empty so long as this position is continued, even if the child strains and cries.

(c.) *Increased Intra-Abdominal Pressure During Defecation, Due to Constipation.*—Children suffering from hernia should not be allowed to become constipated, because the increased intra-abdominal pressure necessary to accomplish the evacuation of the bowels in constipation is in itself sufficient to prevent a hernial opening from closing. This is one of the most common causes of hernia in children, and one of the easiest to be eliminated.

(d.) *Increased Intra-Abdominal Pressure Due to Obstruction to the Passage of Urine as a Result of Phimosis.*—That phimosis is a frequent cause of hernia in children is plain from the fact of the greater frequency of umbilical hernia in male than in female children. The greater frequency of inguinal hernia in male children can readily be accounted for by the difference in the anatomic structures, but this is not the case in umbilical herniæ, which is shown statistically also to be more common in male than in female children. It has lately been suggested that phimosis cannot be an important cause of hernia in children, because if this were the case the Jewish nation must necessarily be much freer from hernia than others. This is, however, not the case. In fact, it has been shown by statistics, especially in Russia, that at the age of twenty to twenty-one proportionally more Jews than Christians are afflicted with hernia. This, however, can be explained by the fact that the Jews are more subject to hereditary diseases of all kinds, on account of the system of intermarriage in families.

If the phimosis is relieved, either by circumcision or by dilatation of the prepuce, and the child kept in bed for four to six weeks with the foot of the bed elevated, the hernia will almost invariably be cured. During the same time the diet and the bowels must be carefully regulated, and it is doubtful which of these three means has been of the greatest importance in obtaining a cure. It is surprising how rapidly the opening will contract under these conditions. Moreover, during this time the patient acquires regular habits which can afterwards be easily maintained if their importance is explained to the mother, and especially if it is impressed on her that by following the directions, which will naturally appeal to her on account of their simplicity and reasonableness, she will be able to make operative treatment unnecessary.

That all of these conditions are of the greatest importance can be demonstrated practically, with the greatest ease, by comparing the relative frequency of hernia in children of the very ignorant poor, of the intelligent poor, and of the well-to-do. In the former class, after the child is weaned, but little attention is given to its diet, to the condition of its bowels, and to the condition of the prepuce in boys, and consequently herniæ are very common, while they are much less common in the second, and still less in the third class.

Strangulated Hernia in Children.—If a strangulated hernia in a child cannot be easily reduced, under complete anæsthesia, by taxis, the child being held in the inverted position during the manipulations, it is undoubtedly wiser to relieve the condition by an operation, because the intestinal wall in children is very delicate and easily injured by taxis. In my experience the hernial opening has always been very narrow; still, I have always succeeded in replacing the hernial contents, without enlarging the opening, by first drawing out more intestine and then gradually replacing it, the child being placed in the inverted position.

If the hernia is an acquired one, which is not common in children, the sac is carefully dissected free to a point within the abdominal cavity. It is then ligated and removed and the ligated stump is permitted to retract into the peritoneal cavity.

If the hernia is congenital it is best to dissect up the neck of the sac for about an inch, and leave the portion surrounding the testicle to form a tunica vaginalis, while the upper portion is carefully dissected up to a point within the peritoneal cavity; it is then ligated, the superfluous portion is cut away and the stump is permitted to retract into the peritoneal cavity, as in case of the acquired hernia. It is thus only necessary to close the skin and the opening will close completely in from four to six weeks if the child is kept in bed with the foot of the bed elevated.

If it is possible to reduce a strangulated hernia in children by taxis, the irritation, caused primarily by the strangulation and secondarily by the manipulation, seems to favor closure of the hernial opening. I have repeatedly seen this occur within six weeks if the child was kept in bed in the inverted position.

The most unfavorable cases are those in which the abdominal walls are congenitally weak, a condition which seems to be hereditary in many patients. Again, of these cases those in which there are three distinct areas of weakness—the abdomen of three hills described by Malgaigne—seem to be least favorable of all. In this class surgical treatment may become necessary, and here it is well to perform the typical Bassini operation, or that described by Ferguson, the important point in the operation being to secure an accurate closure of the inguinal canal to make up for the natural deficiency in the tissues. Two precautions should be borne in mind: 1, The stitches should be tied very loosely, in order not to cause pressure-necrosis of the already weakened tissues; 2, The tissues of the cord in the male should be manipulated very carefully for fear of causing an atrophy of, or preventing the full development of, the testicle. This is especially important in these cases because herniæ in this class of patients are very likely to be double, and if both testicles should atrophy the patient would be permanently injured. In this class frequently no truss will retain the hernia.

There is but one other condition which justifies the operative treatment of hernia in children, and that is when, on account of adhesions, the hernia, although not strangulated, is still irreducible. In this class of hernia a truss cannot be worn with benefit, because it presses on the hernial contents, usually omentum, instead of the empty canal; moreover, the opening not being empty, its closure is necessarily impossible unless the adhesions are absorbed, which, if occurring at all, necessarily requires a long space of time. In this variety of hernia, unless it be complicated with the form just described, it is not necessary to do anything further than in case of strangulated hernia. The hernial sac being removed, the opening will again close spontaneously.

In operation for relief of femoral hernia in children it is never necessary to do anything beyond dissecting out, ligating and cutting away the sac, permitting the stump to retract into the peritoneal cavity, and closing the skin. These cases are exceedingly rare. I have never seen a strangulated femoral hernia in a child, and only once an irreducible one due to an adherent omentum, which necessitated an operation.

USE OF TRUSSES.—Too much stress has been laid upon the importance of trusses in the treatment, and too little on removing the causes, of hernia in children.

It is far easier to retain a hernia and thus encourage the closure of the hernial opening, by first relieving the abnormal intra-abdominal pressure and then applying the truss simply as an aid, than it would be to accomplish the same object by the use of the truss alone.

If it is at all possible it is always best to place the child in bed in the inverted position, and to reduce the intra-abdominal pressure by the methods which have been described, before making use of a truss at all. Then, if it is not possible to maintain this position sufficiently long to obtain a cure it is well to apply a perfectly-fitting truss.

The fact of using a truss does not make the other precautions unnecessary. The child should still be cared for so as to remove intra-abdominal pressure from every cause, and the foot of its bed should still be elevated in order to make use of gravity in keeping the hernia empty and to facilitate the shortening of the mesentery.

The following conclusions seem to cover the treatment of hernia in children:

1. The development of herniæ in children is favored by: (a) faulty development of the abdominal wall; (b) insufficient strength in the tissues involved in closing the umbilical, inguinal or femoral openings; (c) abnormal intra-abdominal pressure; (d) unclosed condition of the tunica vaginalis.

2. The causes (a) and (b) are likely to be inherited.

3. The abnormal intra-abdominal pressure is due: (a) to gaseous distention resulting from improper feeding; (b) to the exertion necessary to accomplish defecation in case of chronic constipation; (c) to the same exertion necessary to evacuate the bladder on account of obstruction due to phimosis; (c) to severe, long-continued coughs.

4. A large majority of all cases of hernia in children will heal spontaneously if the increased intra-abdominal pressure is relieved, the hernial sac being kept empty.

5. This can be accomplished by means of trusses or, much more rapidly, in inguinal and femoral hernia, by placing the child in bed with the foot of the bed elevated, the time required usually not exceeding six weeks.

6. Children with a tendency to the formation of hernia should be guarded against developing coughs.

7. Their diet should be given at regular times and chosen with a view to avoiding gaseous distention.

8. Constipation should be entirely prevented.

9. In case of boys, phimosis should be relieved if present.

10. Badly-nourished and badly-cared-for children of the poor should be treated in hospitals, being placed in bed in the inverted position, the cause of increased intra-abdominal pressure being removed at the time by proper treatment.

11. Operation is indicated (a) in strangulated hernia; (b) in irreducible hernia due to adhesions; (c) in case the opening is unusually large in a free hernia, especially if the condition is hereditary and the hernia cannot be retained by means of a truss; (d) in reducible hydrocele.

12. Except in Class C, the operation should consist simply in carefully dissecting out the sac, ligating it within the abdominal cavity, cutting away the sac and permitting the stump to retract within the abdominal cavity, and simply closing the wound in the skin.

13. The recumbent position, with the foot of the bed elevated, is of very great importance in the operative as well as in the non-operative treatment of herniæ in children.

14. If the child cannot be kept in this position sufficiently long, a well-fitting truss should be worn night and day until there has been no protrusion for at least six months, at the same time the necessary precautions being constantly taken to guard against intra-abdominal pressure from any cause.

HERNIA IN OLD MEN.

It frequently happens that a male patient can easily retain his hernia by means of a truss until he has attained the age of about sixty years, when he is no longer able to do this, and consequently seeks relief through a surgical operation.

He may have become obese or his tissues may have become soft and less able to resist intra-abdominal pressure, but there is an important factor in the increased intra-abdominal pressure required in emptying the bladder on account of an obstruction to the passage of the urine, caused by the presence of an enlarged prostate gland. This condition is very common in old men.

In quite a large proportion of these cases there will be a rapid reduction in the size of the prostate gland, if either a vasectomy or an orchidectomy is made.

Both of these operations can be made very easily in connection with herniotomy without increasing the danger to the patient, and as both of these operations remove some of the loose tissue in the inguinal canal they favor permanency of cure in two ways: 1, by making the union between the layers to be united more perfect, and 2, by decreasing, indirectly, the excessive intra-abdominal pressure by reducing the size of the prostate gland.

STRANGULATED HERNIA.

This patient, a married woman, forty-six years of age, has just been brought to the hospital. From her daughter we learn the following history: The patient has been married for twenty-six years; has never been very strong, but always comparatively well. She is the mother of four healthy children. For many years she has felt a weakness in the region of the left groin and since twelve years she has known of the presence of a femoral hernia, which, however, has given rise to but little distress except when she has worked beyond her strength. Occasionally the hernia has become painful and the patient has experienced difficulty in reducing it, but this has never been serious in character and she has always succeeded in obtaining relief by lying down and applying hot cloths to the part for an hour or two.

Three days ago the patient suddenly became severely nauseated and suffered from great pain in the abdomen. She attributed this to something she had eaten and imagined that the condition would soon improve. She consequently made use of home remedies and did not send for her physician until about sixteen hours ago. When he arrived he found the patient very ill. She still continued to vomit, there had been complete obstruction to the passage of gas and fæces, the abdomen was moderately distended with gas and the abdominal walls were tense. In the region of the left femoral ring there was a hard mass the size of a hen's egg. The pulse was a little over 100 and the temperature 101° F.

The physician made a diagnosis of strangulated femoral hernia, but as the patient did not suffer from severe pain in the vicinity of the hernia he did not lay very great weight upon this part of the diagnosis. He elevated the foot of the bed in order to make use of gravitation for the purpose of reducing the hernia, gave a hypodermic injection of morphia to relax the muscles, directed the patient to remain in the position assumed and continue the application of hot fomentations. He also forbade the giving of any kind of food by mouth.

The physician then left the patient and returned after six hours, only to find her condition very much worse in every respect. He now advised an immediate operation, but the husband could not be found for seven hours more, and by the time the latter was convinced of the necessity of an operation the patient was in the condition in which you see her. Her face is pale, lips blue, respiration very shallow, pulse imperceptible, and she is without doubt in a dying condition. You can observe the pupils becoming more and more dilated, indicating that death will occur within a few moments.

This case is unusually instructive because the conditions present here are so frequently encountered in practice.

In the discussion of hernia operated for the radical cure, when not strangulated, the fact was pointed out that the operation is almost absolutely safe, the death of a case depending upon an accident. The same is true in operation for the relief of strangulated hernia at the beginning of the attack, because the only additional condition, the strangulation, can be relieved without difficulty and without danger to the patient so long as there has been no injury to the strangulated intestine. Consequently every death following a strangulated hernia—barring the accidents which may occur in connection with any operation—is due to the fact that a physician has not been called at the beginning of the attack, or his advice to obtain immediate relief has not been accepted, or the physician himself has wasted valuable time.

There can be no doubt but that all temporizing in the treatment of strangulated hernia should be strongly condemned, because cases in which relief is obtained in this manner could all be relieved by manipulation of the hernia under an anæsthetic, and those which are not relieved would recover were they operated early. Every year thousands of patients lose their lives unnecessarily from strangulated hernia because time is wasted either on account of their own ignorance or stubbornness, or on account of carelessness in examination by the physician called or his lack of decision in obtaining relief at once. Moreover, it should be remembered that any practitioner who has sufficient intelligence and training to have clean hands and instruments will save a larger proportion of cases suffering from strangulated hernia at the beginning of the attack than will be saved by a surgeon of the very greatest skill and training after the tissues involved have become gangrenous.

At this point I wish to make a suggestion which seems to be of great practical importance so long as patients and their friends are justly afraid of surgical operations for the relief of strangulated hernia because many of their friends who have submitted to this operation have not recovered. It is difficult for the layman to understand that his friend died, after an operation for the relief of strangulated hernia, because the operation was performed when he was already in a hopeless condition, for this fact should have prevented the operation which was at least useless, as was shown by the result. It is difficult for him to understand why his own chance of recovery should be better than his friend's, inasmuch as his friend was urged to submit to an operation with the same arguments that are being employed in his case. In other words, the large number of deaths following operations for strangulated hernia, which have been postponed until the patient was in a hopeless condition, prevents the operation in the case under consideration until it is too late.

This prejudice can usually be overcome in the following manner: Describe to the patient the condition which is present; tell him that a loop of intestine is caught in a ring and constricted as tightly as would be his finger were a string tied about it sufficiently firm to prevent all circulation of blood. He will understand that this must soon be followed by death of the tissues and that then the contents of the intestines will leak into the abdominal cavity and that this will be followed very speedily by his death. Tell him that you will make every effort to reduce the strangulation by manipulating the tissues, in order to induce the intestine to slip back through the ring. Place the patient on a couch or a board, or if this cannot be obtained take a door out of its frame and lay the patient on it; then elevate the lower end of this so that it will be at an angle of about 40° with the floor. Have him draw up his knees and then manipulate the protruding portion gently, so as not to cause any injury to the intestine, remembering that the longer the strangulation has existed, the more gentle must be the manipulations.

It is well to permit the patient to manipulate the hernia himself while he is in this position, because he is frequently more experienced, and consequently more successful than the physician. If reduction is accomplished, it is well, if not, it is best to explain to the patient that by relaxing the muscles with the use of an anæsthetic, you may still be successful, but if this fails, it will become necessary to sever the circular band which prevents the reduction of the hernia.

This will seem so reasonable to the patient that, in my experience, with only one exception, the patient has always consented when I have placed the conditions before him in this manner. One substitutes the object, namely, the reduction of the hernia, for the operation in the mind of the patient. This is really important.

It is best to permit the patient to continue in the inverted position while the necessary preparations are being made, which should be very simple, as described in the section on preparation for operation. If a colleague is available he should be called in the meantime, if not, this should not interfere with the plan of action, because time is the element of greatest importance in these cases.

If the patient is in a hospital it is wise always to anæsthetize the pharynx by spraying it with a four per cent. solution of cocaine in water, and insert a stomach tube and carefully wash out the stomach, because these patients frequently vomit during the operation and inspire the offensive material which has decomposed in the stomach, and a pneumonia is the result. In a private house, especially in the country, these preparations may not be possible, although it is well always to carry a stomach tube.

In this case, the patient may be protected by being kept in an exaggerated Trendelenburg position throughout the anæsthesia, because in this way the vomited material will escape from the mouth by gravitation before it can be inspired.

When the patient has been thoroughly anæsthetized another attempt may be made to reduce the hernia, and if this fails, herniotomy should be performed at once. During these manipulations it is again necessary to bear in mind that if the strangulation has lasted only a few hours a considerable amount of force may be exerted with safety, while it is not wise to use any force if the strangulation has existed for more than twenty-four hours for fear of rupturing the intestine.

Before describing the operation I wish to direct attention once more to the history in this case, which is quite characteristic in many respects. 1. The onset was sudden. 2. There were severe spasmodic pains in the abdomen. 3. The patient suffered from nausea and vomiting and consequently attributed her trouble to an error in eating. 4. There had been complete obstruction to the passage of gas and fæces. 5. There was a history of the presence of a hernia. 6. A mass existed in the groin. 7. The patient felt severely ill from the beginning. 8. She went into a hopeless condition of collapse very suddenly.

The physical examination, when first seen by the physician at the beginning of her collapse, showed a patient with a bad facial expression, the tongue was thickly coated, temperature and pulse not very high, but the pulse bad in character, the patient was restless, the abdominal walls were tense, the abdomen somewhat distended with gas. The peristalsis of the small intestines could be distinguished through the abdominal wall to some extent. There was complete obstruction to the passage of gas and fæces. In the inguinal region there was a very tense swelling which could not be reduced.

Differential Diagnosis.—The history of a reducible hernia which had existed for a considerable period of time, and the presence of an immovable mass in the inguinal region at the point at which the reducible hernia could be located by the patient, would in itself warrant a positive diagnosis of strangulated hernia in the presence of complete intestinal obstruction.

Without the previous history of a reducible hernia the mass in the groin might be due to a severe inflammation of the inguinal lymph glands. I have seen a case of acute intestinal obstruction due to perforative appendicitis, complicated with bubo, in which the latter might have been diagnosed as a strangulated hernia had not the attending physician treated the patient previously for a specific urethritis. The most common mistake in diagnosis is that of acute gastritis, because the physician is willing to make a diagnosis from the history alone without making a physical examination of the abdomen, the patient either neglecting to mention the fact of having a hernia or this fact being passed over without notice. An acutely inflamed tumor in this region may be mistaken for a strangulated hernia.

In quite a number of these cases which have come under my observation the patient insisted that the hernia had been irreducible for many years and that it could consequently not be the cause of the severe gastric disturbances. Moreover, the attack came on directly after some indiscretion in eating and must consequently depend upon this and not upon the hernia, which had remained unchanged. The unusual hardness of the hernia is supposed to correspond to the tension in the abdominal walls, due to the intra-abdominal irritation. In this manner a strangulated hernia is mistaken for a simple irreducible hernia which is caused by the adhesion of a portion of the omentum within the hernial sac.

In these cases the operation usually shows that a loop of intestine has slipped into the hernial sac alongside of the omentum and has become strangulated by the sharp ring formed by the connective tissue in the neck of the hernial sac.

A strangulated right inguinal, or femoral hernia, may be mistaken for an acute appendicitis. In three instances I have encountered a gangrenous appendix in a strangulated hernia, and many of these cases have been reported.

A strangulated hernia so small as to be overlooked has been mistaken for every variety of mechanical obstruction of the bowels, but if a careful physical examination has been made this is not likely to occur.

In almost every case in which an error in diagnosis is made in strangulated hernia this is due to the fact that the physical examination has not been sufficiently careful.

ÆTIOLOGY.—The strangulation is usually due to the fact that a small loop of intestine has been forced out into the hernial sac, which existed previously, by some unusual exertion, and that the connective tissue forming the neck of the sac has constricted the intestine at the point at which it issued from the abdominal cavity, and, interfering with the return circulation, the portion of the intestine contained in the sac becomes congested and œdematous. The drainage from the lumen of the intestine is obstructed at the same time, which favors the multiplication of the micro-organisms contained in the intestinal contents. With the increasing œdema the circulation is presently shut off entirely and the loop of intestine becomes gangrenous and perishes, becoming an excellent nourishing medium for the micro-organisms in its lumen.

In the meantime the complete intestinal obstruction has injured the portion of the intestine above the constricting ring, because there is a certain amount of tension upon the mesenteric vessels interfering with the nutrition. The pressure within the lumen of the intestines is greatly increased by the accumulation of gas within the bowel, due to the decomposition of the contents which cannot be expelled. Too often this pressure is increased to a marked extent by the administration of food and cathartics by mouth. Presently the distention of these intestines will be sufficient to permit transmission of micro-organisms contained in their lumen resulting in a direct infection of the peritoneal cavity. In the meantime again the infection from the gangrenous intestine within the hernial sac may result in a thrombosis of the mesenteric vessels in the intestine in the peritoneal cavity, causing an extension of the gangrene.

TREATMENT.—From the moment a patient with strangulated hernia comes under our care we must prohibit the giving of food and cathartics by mouth absolutely, because this can only serve to increase the pressure within the intestine and may also serve to force infectious material through the intestinal wall.

If the patient comes under care within the first twenty-four hours it is usually safe to make quite a prolonged effort to reduce the hernia by means of manipulations, the patient lying upon his back with the lower end of the table or couch elevated to an angle of about 40°, with the knees drawn up in case of femoral or inguinal hernia, or with the patient lying flat on his back in case of umbilical or ventral hernia. But even in these cases which come under care early, we must be careful not to injure the intestine by using too much force. If the strangulation has existed much longer, still greater caution, as before mentioned, must be exercised. This is especially true of very small herniæ in which the intestine is often hopelessly destroyed even after thirty-six hours, in which case its return to the abdominal cavity would almost inevitably result in a diffuse peritonitis and death of the patient.

Failing in the reduction, an immediate operation is of course indicated, and this can usually be done directly after the attempt at reduction under anæsthesia has been made without permitting the patient again to gain consciousness.

PREPARATORY TREATMENT.—If possible, it is always best in these patients to perform gastric lavage as described above. Aside from this nothing need be done beyond carefully scrubbing, shaving and disinfecting the field of operation and covering the remaining portions of the body with sterilized towels.

OPERATION.—I will here speak of the three common forms of strangulated hernia, femoral, inguinal and umbilical, together, because the same principles apply to all alike.

An incision is made over the center of the swelling, the successive layers of tissues being elevated between two pairs of dissecting forceps in order to facilitate the work by protecting the underlying tissues. If the hernia has existed a considerable period of time the discolored intestine will shine through the hernial sac, which may be smooth and shining, or it may be roughened and adherent to the overlying tissues. This condition is especially likely to be present if the hernia has existed for a long time, and if a tightly-fitting truss has been worn.

If the layers are picked up with two pairs of forceps and the incision is made only through tissue thus elevated there is no danger of wounding the intestine within the hernial sac. Occasionally one encounters a thick layer of pre-peritoneal fat on the outer surface of the sac which looks so much like omentum that it is quite confusing. It is well to watch for the hernial fluid which can always be found in the sac in strangulated hernia. Frequently there is a sufficient quantity to protect the contents of the sac from injury in making the incision, but quite as often the quantity is very slight; still I believe it is always sufficient to indicate the fact that the sac has been opened.

There is, however, one source of error which has been observed in practice. Occasionally the bladder is drawn into the hernial sac and this has been opened and the urine which escaped has been mistaken for hernial fluid. In case of doubt in this direction it is well to introduce a steel sound into the bladder and to examine this organ in the direction of the hernia. In case the accident has happened it is best to suture the wound in the bladder at once with a double row of Lembert sutures of catgut. It is necessary to observe three precautions in suturing such a wound in the bladder: 1. The stitches must be applied with great regularity in order to make the closure impermeable to water. 2. The stitches should not protrude into the cavity of the bladder, in order to prevent formation of stone. 3. They should be tied sufficiently loose to prevent pressure necrosis at any point.

After the hernial sac has been opened and the hernial fluid carefully sponged away, the intestine should be inspected. If this is covered by an uninjured, smooth, shining peritoneum it is likely that the intestine will revive even though it may be quite black. It is not wise to attempt its reduction without enlarging the constricting ring at the neck of the hernial sac because the strangulated loop of intestine has already suffered so severely that it is injudicious to injure it further by unnecessary manipulations.

Many methods of cutting the constricting ring have been advised, but unless the operator has through experience acquired especial skill in the use of one of these methods I would advise him to make the incision through all the tissues sufficiently free to expose the edge of the constricting ring and then to introduce preferably a Kocher director between the intestine and the ring and then a scalpel or the blade of scissors between this and the ring, making an incision transversely across the constricting tissues. The strangulation is not usually caused by the tissues of the abdominal wall, but by a hard, inelastic, fibrous ring developed from the tissues composing the neck of the hernial sac.

In femoral hernia it is well to cut inward in order to cut away from the femoral vein. In inguinal hernia it is well to cut in the direction of the inguinal canal, first splitting the fibers of the fascia of the external oblique abdominal muscle as described in the operation for radical cure of inguinal hernia. If it becomes necessary to cut the constricting band without having it exposed to sight, it is well to insert the finger into the canal in order to determine whether the epigastric artery is in the normal position. If it is it can be easily avoided, if it is not, it will be best to enlarge the external wound until the constricting portion is in view, when it can be cut safely over a director or over the finger which has been inserted between the intestine and the constricting ring. It is now possible to draw out a further portion of the intestine for inspection. If only one portion has been hopelessly destroyed by the pressure, this will be found just at the point where the intestine was grasped by the constricting ring. Frequently the dark color of the entire loop which was found in the hernial sac will begin to disappear after the ring has been cut and the circulation in that portion of the intestine is becoming re-established.

Covering this portion with pads moistened with warm, normal salt solution for a minute or more the intestine appears more and more normal and when irritated by touching it the muscles respond by contracting. In such case it is safe to return the intestine into the abdominal cavity and so complete the operation as described under radical cure.

Even if there is no musclar contraction, but a satisfactory return of the circulation, it is safe to return the gut, provided the peritoneal covering is smooth and shining. If, however, there are areas of tissue upon the peritoneal surface which are roughened, or if portions show by their thinness that some of the deeper layers of the intestinal wall are actually necrotic, it becomes necessary to remove the gangrenous portion and to unite the two portions of intestine thus severed.

The upper branch of the intestine is always the one which has suffered most because the peristaltic pressure has forced intestinal contents down to the point of obstruction, consequently this portion of the intestine is often greatly distended with gas and fæces.

Before cutting away the gangrenous portion of intestine it is necessary to provide against infection of the peritoneal cavity from its contents by carefully placing warm, moist pads of gauze about the loop. Two pairs of long-jawed compression forceps are applied half an inch apart, and two or three inches from the gangrenous intestine, upon the lower segment, which is ordinarily nearly normal, so as to close the lumen of the intestine completely, the points of the forceps reaching about half an inch beyond the mesenteric attachment of the intestine. An incision is made down to the mesentery between these two forceps, then the mesentery of the gangrenous portion of the intestine is transfixed and ligated with catgut. It is best to do this in several sections in order to prevent slipping of the stump.

The intestine is cut loose from its mesenteric attachment and if greatly distended above the gangrenous portion it is well to have the patient rolled over to the side of the operation, and after carefully applying moist gauze pads about the wound to place the end of the intestine which has been cut loose from its mesentery into a basin, to grasp the cut edge at different points with hæmostatic forceps and then to remove the long-jawed forceps closing the end of the intestine. In this manner the loosened intestine will act as a tube through which the contents of the upper intestine may safely be emptied.

In order to obtain a safe point to unite the lower with the upper segment of the intestine it is necessary to sacrifice, in most cases, quite a long piece of the upper segment. It is a better plan to close both cut ends of the intestine and to make an anastomosis between the lower segment near its end and the upper segment far enough from its end to be certain that the intestinal walls are quite normal. In this way quite as good a union can be obtained as by resecting a large portion of the upper segment, and much time is saved in the operation, as well as much shock, because the amount of traumatism is very greatly decreased in this manner.

The portion of the upper segment of the intestine below the point of anastomosis remains perfectly harmless.

The methods of closing the ends of the severed intestine and making the anastomosis are fully described in the section on intestinal surgery.

After operation for strangulated hernia no food should be given by mouth for several days, and then only predigested food and later broths, soups and milk. The patient may be nourished by enemata consisting of one ounce of some predigested food dissolved in three ounces of normal salt solution given every four hours. Cathartics should not be given until at least a week after the operation, and then only mild salines in small, often repeated doses. Small sips of very hot water can usually be given from the first.

The treatment of the wound must be left to the judgment of the operator. If it seems wise to close the wound this is done in the manner described in operations for radical cure, except in femoral hernia. In femoral hernia the defect made in the ring by cutting the constriction must be repaired in order to prevent the recurrence of the hernia. This can be accomplished very readily with a few interrupted, chromicized, catgut stitches. In all other respects the same methods may be followed as in operation for radical cure.

If in any given case it seems unwise to close the hernial opening at once it is well to insert a glass or rubber drainage tube, covered with iodoform gauze, through the hernial opening down to the injured intestine. It has been my practice to withdraw this tube on the second or third day and after that to withdraw the gauze gradually, by pulling upon it as much as seems wise each day. If the wound suppurates, it is to be treated like an infected wound elsewhere. If it remains aseptic it may be closed by means of secondary sutures a week after the original operation.

This operation must frequently be performed in old and feeble patients, and these do not bear confinement in bed well. It is consequently wise to encourage their moving about in bed and sitting up early.

If a fæcal fistula occurs it is well to continue the feeding by enema for two or three weeks, which will usually suffice for a spontaneous cure. If the fistula persists it may become necessary to make an abdominal section for its relief, the technique of which will be found under intestinal surgery.

If the patient seems too weak to bear the operation of anastomosis of the two portions of the intestine, or if the operator who performs the operation does not feel competent to perform this part of the operation, temporary relief may be given by drawing out the intestine for a distance of two or three inches through the enlarged hernial opening, placing strands of gauze between the intestine and the edges of the opening, ligating the mesentery of the gangrenous portion, cutting away the latter and leaving the ends of the intestine open for drainage and leaving the construction of an anastomosis for future consideration.

The points which should be impressed especially in connection with this subject are: 1. The necessity of always making a physical examination in cases suffering from intra-abdominal pain, nausea or vomiting and always to examine for hernia in these cases because this will enable the physician to make an early diagnosis. 2. The necessity of relieving the strangulation at once. 3. The fact that these cases are more likely to recover if relieved of the strangulation early by a clean physician or surgeon with little or no experience, than by a surgeon with the greatest possible skill if operated late.

Abdominal Surgery.

There are a few conditions connected with abdominal surgery which may be considered in a general way because they apply to all operations in which the abdominal cavity is opened.

Preparatory Treatment.—In performing intra-abdominal operations the matter of space is of great importance, because an abundance of space facilitates the operation to a marked degree.

It is astonishing how much space can be gained by securing an empty condition of the stomach and intestines. If these are filled with food, gas and excrement, the simplest operation may be quite difficult, while it will be many times less troublesome if the intestines are as empty as possible. Moreover, the proximity of decomposing intestinal contents to the seat of operation is not to be desired. With only the thickness of the intestinal wall between the wound and this material the patient is not nearly so safe as he would be were the alimentary canal empty.

Cathartics.—No other cathartic has accomplished this condition so thoroughly, in my experience, as castor oil, given in the foam of beer or malt extract on the day preceding the operation. We have found that two ounces is the most satisfactory dose. If given in this manner it rarely nauseates the patient, it causes very little or no pain, and it is certainly effective in almost every case, leaving the intestines free from gas and fæces. It is well to give only sterilized food for twenty-four hours previous to the operation, preferably sterilized milk or broths.

Diuretics.—After many intra-abdominal operations there seems to be an interference with the functional activity of the kidneys, rather more marked than in any other operations not performed directly upon the kidneys or urinary tracts. It is consequently wise to encourage their activity on the day before the

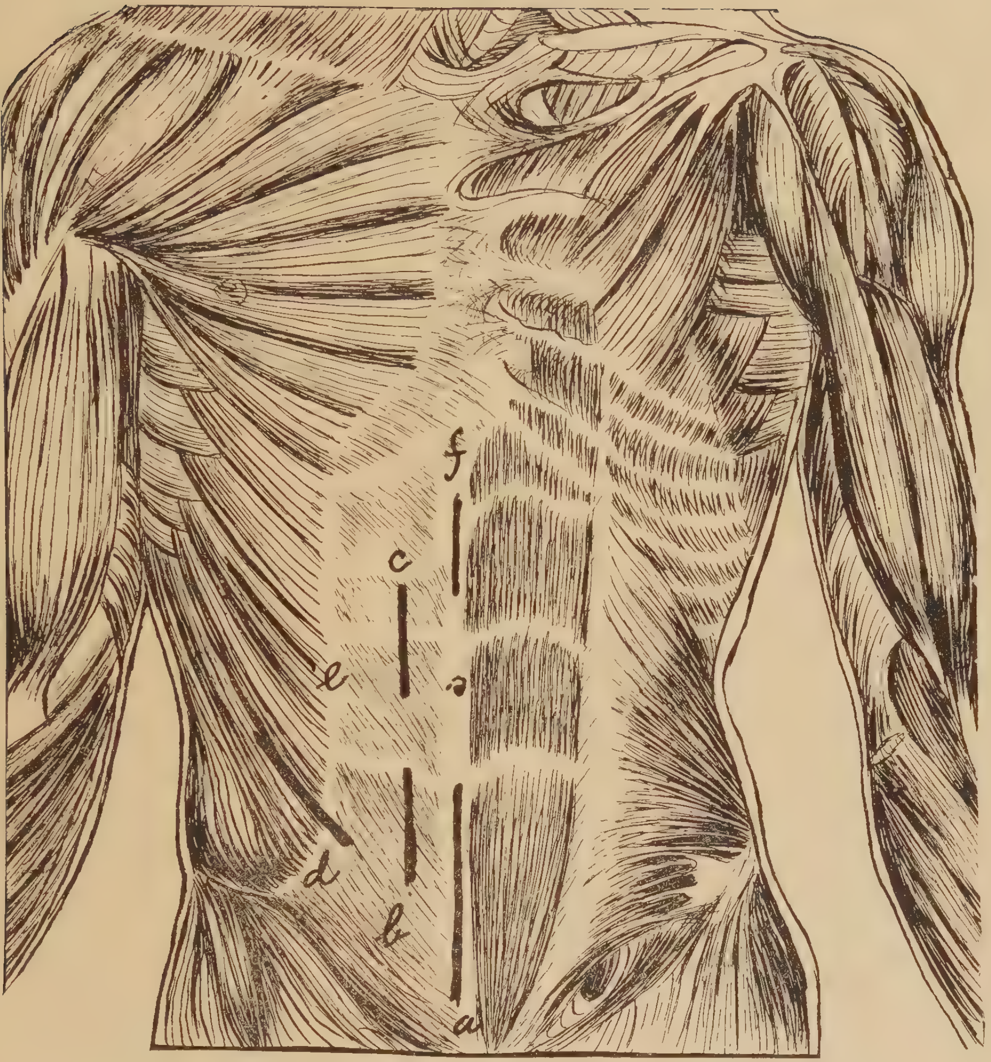


PLATE XV.

LOCATION OF ABDOMINAL INCISIONS.

Represents the abdominal muscles with the various lines of incisions indicated on the right side; the same incisions may, of course, be practised on both sides of the abdomen, but the location of the vermiform appendix and the gall bladder makes these incisions more common on the right side. On the left side the external oblique abdominal muscle has been removed, showing the rectus abdominis and the internal oblique; (a) represents the incision through the linea alba below; (f) above the umbilicus; (b) through the outer edge of the right rectus abdominis muscle below; (c) above; (d) McBurney's incision; (e) the same incision over the kidney.

operation by giving pure water, preferably hot, in considerable quantities.

The hot bath which has been mentioned in connection with the preparation of patients for operation in general is especially useful in these patients, because it stimulates the process of elimination through the skin as well as through the kidneys.

Abdominal Incision.—In making an incision through the abdominal wall, the anatomical layers composing this wall should be considered, because if they are not the closure of the abdominal cavity after the intra-abdominal operation has been completed may not be satisfactory and may result in a weakened point in the wall which may presently develop into a hernia, and this may be a many times more serious affliction to the patient than the condition for which the operation was originally performed.

Plate XV shows the arrangement of the layers of the abdominal muscles, together with the location and direction of the normal incisions through the abdominal wall in the median line and on the right. Of course, the same relative positions would be suitable on the left side, although on account of the location of the gall bladder and the vermiform appendix on the right side, many more abdominal sections are made through this than through the left side of the abdominal wall.

The incision marked *a* is suitable for all operations upon intra-abdominal organs located in the pelvis. In cases of chronic appendicitis the vermiform appendix can also be removed through this incision.

The incision marked *b* is suitable in cases in which the vermiform appendix and the right ovary and tube are implicated; *d* indicates the incision known as McBurney's incision for the removal of the appendix; *c* is favorable for operations upon the gall bladder and the appendix can usually also be removed through this incision; *e* offers the same advantages in the hypochondriac region that *d* gives in the iliac region; *f* furnishes an approach to the stomach.

In *a* and *f* the incision is made through the linea alba between the recti muscles; *b* and *c* split the fibers of the recti muscle, and *e* and *d* split the fibers of the external oblique muscle, then the edges of this muscle are retracted and then the fibers of the internal oblique are separated, the incision extending at right angles to the fibers of the external oblique. The incision is then extended through the fibers of the transversalis fascia and the peritoneum.

In all of these incisions none of the abdominal muscles are cut at right angles, which is of the greatest importance, for were they cut at right angles their ends would be retracted, and the more the muscles contract the more the wound shows a tendency to gap. In closing a wound in the abdominal cavity in which some of the muscles have been cut at right angles it is often impossible to secure a satisfactory union between the cut ends of the muscle.

The conditions are entirely different if the muscle fibers have only been split according to the scheme indicated in Plate XV, because the natural contraction of these muscles has a tendency to bring their edges close together and to cause a spontaneous closure of the abdominal wound in this manner.

Each one of these incisions will be carefully described and illustrated in connection with cases in which it is to be employed.

These incisions may, of course, be changed as regards their distance from the median line, their length and their position upon the abdomen, so long as their direction corresponds with that of the muscles of the abdominal wall.

In order to make the position of these incisions more clear, I have shown them in Plate XVI upon the surface of the body, without indicating the direction of the underlying muscles, using the same letters as in Plate XV for the various incisions.

TRAUMATISM.—In no form of surgery is it more important to avoid unnecessary traumatism than in abdominal surgery. This can be accomplished by eliminating from the field of operation the portions not implicated in the disease by tamponing them away with large pads of soft, aseptic gauze, moistened with warm, normal salt solution. These should be applied carefully and gently, in order not to cause any traumatism, and left in place until the operation upon the diseased portion has been completed.

None of the intra-abdominal tissues not implicated in the disease should be manipulated during the operation, in order to avoid unnecessary shock and possible infection and consequent adhesions. Manipulation of inflamed or congested intra-abdominal organs is

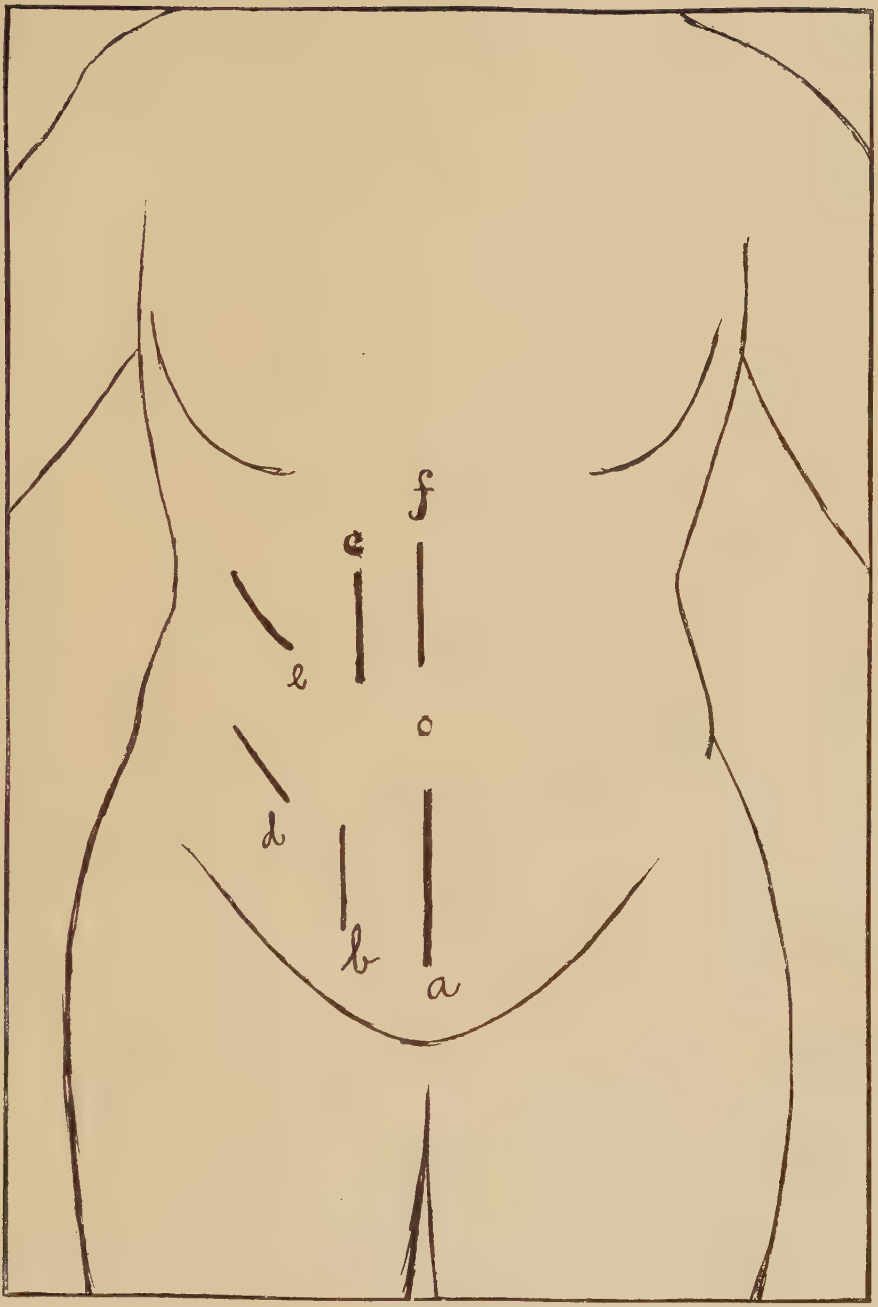


PLATE XVI.
Location of Abdominal Incisions.

Represents the same incisions as shown in Plate XV drawn upon the skin. The various incisions are lettered to correspond in the two plates.

especially likely to give rise to shock, and in these cases it is consequently even more important to limit the manipulations as much as possible. So long as the peritoneal surface has not become abraded the likelihood of infection is very greatly reduced, and the less these organs are manipulated the less likely are they to suffer the abrasion of their peritoneal surfaces.

GASEOUS DISTENTION.—Much of the discomfort following abdominal sections results from the gaseous distention of the intestines. This can be reduced to a very marked extent if the alimentary canal has been thoroughly emptied before the operation and if no food be given by mouth for a day or two after the operation.

The patient can be supported very well by the administration of one of the numerous predigested foods in the market given by enema. One ounce of this is given in three ounces of normal salt solution every three to four hours. Or if this is not convenient, a simple enema of four ounces of normal salt solution given every three to four hours seems to relieve the feeling of hunger.

The amount of pain suffered after an intra-abdominal operation is also greatly reduced if no food is given by mouth. In case, however, there should still be a considerable amount of pain, this can be relieved safely by the use of morphia given hypodermically. This is not safe when food has been administered, because the relaxing influence of morphia upon the intestinal walls will have a tendency to increase the gaseous distention and the consequent absorption of products of decomposition.

It is this tendency to decomposition, in place of digestion of food given by mouth shortly after an operation, which makes it virtually of no use to the patient, because he obtains no nourishment from the food so taken, while the absorption of the products of decomposition is a real injury. There is, of course, the further advantage in this feature of the after-treatment that it secures a condition of rest for the tissues which have been subjected to traumatism, which in itself is of very great importance.

APPENDICITIS.

In the consideration of this subject I will take a number of cases which have come under care and follow them through the various stages of their disease, precisely as they progressed, which will give a much more perfect idea of the plan of treatment I would advise than could be given in describing the treatment without reference to actual clinical cases.

CHRONIC RECURRENT APPENDICITIS.

The patient before us, forty-four years of age, a machinist by occupation, gives the following history: Ever since he was a boy he has had occasional attacks of severe colicky pains in the abdomen. These were always accompanied with nausea, never with chills or vomiting. From the age of twenty to thirty-two he always carried some morphine pills, which he took during these attacks, which never lasted more than a few hours. At this time a diagnosis of gall stones was made. He always abstained from taking food during the attack and ate sparingly for a week or two following. At times the attacks occurred every week, then they would disappear for a month, then for six or eight months, and between the age of thirty-four and forty-two he was entirely free from actual attacks, but constantly suffered from digestive disturbances. Fifteen months ago he had a recurrence which was more severe than any attack he could recall. It compelled him to remain in bed for several days and left a point in the right inguinal region which was tender upon pressure. Since that time he has had eight attacks, each one a little more severe than the previous, and each sufficiently severe to prevent him from going to his work for from three to ten days. His last attack commenced ten days ago and he has been confined to bed during this time, although he has not been severely ill. During these attacks he has abstained from food for the first two to five days, and after that he would take soups and milk.

PRESENT CONDITION.—Slightly built man, muscular development good. Heart, lungs, liver and kidneys normal; abdomen soft. Upon inquiry he points to the right inguinal region as the seat of his trouble. Nothing abnormal can be found here except pain upon deep palpation. This also reveals an area of induration, which is, however, very small. His temperature is below 100° F., pulse 88, tongue coated.

One peculiarity to which the patient directs our attention is the fact that during the early attacks the pains were spasmodic and came in waves. The patient describes them as though something were grasping a tender portion of his intestine and squeezing it and then loosening the grasp, only to tighten again. During the past two years this condition has changed and now the pain is more constant and dull.

DIAGNOSIS.—*Chronic Recurrent Appendicitis.*—I would explain the peculiarity regarding the character of the pain by the change in the tissues of the appendix. The muscular coats have suffered severely and do not respond to irritation as they did at first, consequently the spasmodic character of the pain has disappeared.

This is not at all an uncommon history. A man (or woman) formerly in apparent perfect health and able to perform hard labor, suffers for a period from a moderate disturbance of the digestion; then there is an acute attack of appendicitis from which the patient recovers only to find the digestive disturbance exaggerated. The patient returns to work, but soon has a second acute attack of appendicitis, from which he again recovers, only to repeat his former experience. If he has his own business, or is engaged in the pursuit of a profession, he soon falls behind his competitor and is compelled to make great sacrifices. If he is in the service of others his employer will soon replace him by a man who can be depended upon.

I have encountered many of these patients suffering from chronic recurrent appendicitis whose prospects in life have been ruined, as in the case before us, on account of their disease. This, in itself, is an ample indication for radical treatment, provided that it will not result in complications and is not connected with much danger, but is likely to result in a permanent cure. Yet there are other valid reasons why an attempt should be made to relieve this patient permanently. With each successive acute attack he is exposed to a certain amount of danger to life; the fact that a patient has recovered from several attacks does not indicate that he will always in the future be so fortunate. Moreover, the fact that his digestion is becoming more and more impaired is certain to affect his chances for a long life.

It is likely that this indigestion results in the absorption of a considerable amount of products of decomposition. In the same way, septic material is likely to be absorbed from the lumen of the obstructed appendix.

That a permanent cure is to be looked for, after the removal of the diseased appendix, we know from clinical experience. The conditions for operation are so favorable that complications or unfavorable secondary effects are not to be expected. The general condition of the patient is fair, his temperature and pulse are normal, he is not suffering from an acute infection. It has been possible to empty the intestines thoroughly before the operation, which will facilitate the operation and the recovery. It will not be necessary to cause much traumatism, and any abrasions which may occur in loosening adhesions can readily be covered with peritoneum. It will not be necessary to drain the abdominal wound or to make this especially large, hence there need be no fear of the occurrence of a ventral hernia. Consequently we can reasonably eliminate the fear of complications.

Concerning the danger of the operation I would say that in my own experience there is a mortality in cases like the one before us of less than one in five hundred, or one-fifth of one per cent., and that due to an accident which might occur with the simplest operation of any kind.

For these reasons I have advised the removal of the appendix in this case, which we will proceed to do.

Operation.—I wish to direct your attention to the fact that the patient's abdominal walls are loose and that the intestines are not at all distended with gas. This is due to the preparatory treatment consisting in the administration of two ounces of castor oil

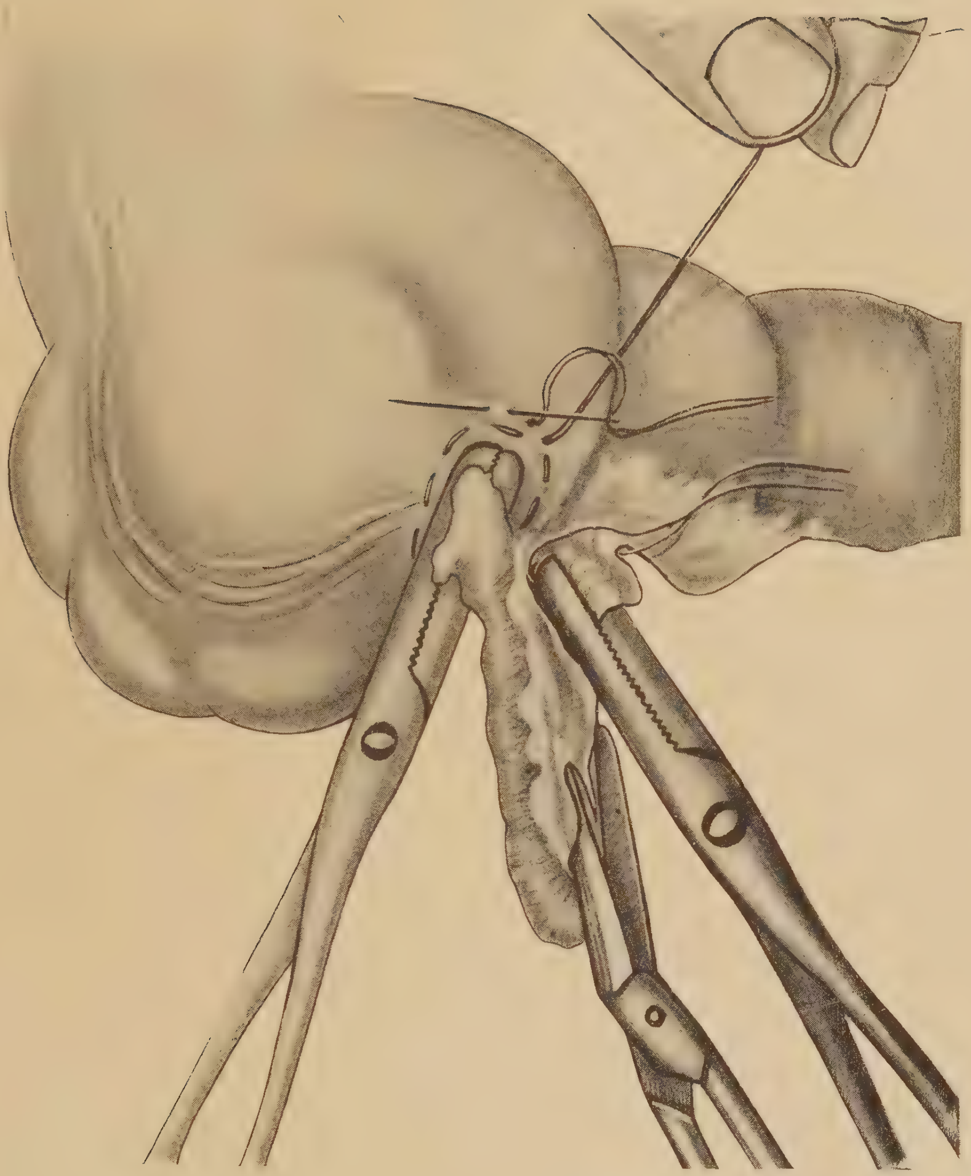


PLATE XVII.

EXCISION OF APPENDIX.

Represents the excision of the vermiform appendix, a clamp being placed at the base of the appendix, a second one upon the mesenteriolum; a ligature is in position to tie the mesenteriolum; the scissors are in position to cut the mesentery between the appendix and the clamp upon the former; a purse-string suture has been placed about the base of the appendix upon the end of the cæcum.

twenty-four hours ago and a sterilized liquid diet for the same period.

The field of operation has been prepared in the usual way and it will now be separated from the remaining portion of the surface of the body by means of sterilized towels, a sufficient amount of space being left free so that all the manipulations necessary during the operation can be carried out without disturbing the towels, for we must not carry any infectious material from the lower surface of these towels to the seat of operation.

Incision.—The incision in this case, Plates XV and XVI d, will be made parallel with Poupart's ligament, crossing a point half way between the anterior superior spine of the ilium and the umbilicus, so that one-third of the incision will be toward, and two-thirds away from, the median line of the body as regards the above point. This incision is carried down through skin, fascia, fat and the external oblique abdominal muscle and fascia, splitting the fibers of the latter in their course. The incision through the external oblique may be made an inch shorter than that in the skin and it will still furnish a sufficient amount of space. The edges are now retracted and you observe the direction of the fibers of the internal oblique abdominal muscle at right angles with the incision. These fibers are also separated without cutting, and we expose the strong transversalis fascia, which is closely attached to the peritoneum. This is picked up between two pairs of dissecting forceps, one in the surgeon's hand and one in the hand of an assistant. It requires a little care to avoid picking up omentum or intestines at the same time, but by lifting the transversalis fascia with one pair of forceps, then picking it up with the other, then changing the position of the first pair slightly, any intestine or omentum which may have been picked up at first is likely to be dropped again. The transversalis fascia and the peritoneum are incised carefully, then a pair of small hæmostatic forceps is applied to the edge of this wound or it is transfixed with a needle and silk to facilitate its manipulation when the wound is to be closed.

The omentum immediately comes into view crowding itself into the opening to protect the underlying intestines. When this is pushed to one side the cæcum is exposed. This can be recognized by the band of longitudinal muscles extending along the anterior surface of this intestine. Following this band downwards invariably leads to the appendix. By bearing this fact in mind it is possible to find the appendix with the slightest amount of disturbance of the intra-abdominal organs; the manipulations being confined to a very small area. In this case the repeated recurrences, with their acute inflammatory disturbances, have resulted in extensive adhesions, the appendix being club-shaped at the end and somewhat bent upon itself. Its proximal third is loosely adherent to the lower end of the cæcum, while the remaining portion is strongly adherent to the anterior surface of the iliacus muscle.

A sufficient amount of time has elapsed since the last attack to make it safe to loosen these adhesions without fear of opening an abscess, because all infectious material has undoubtedly been absorbed.

The cæcum, together with the appendix, is now brought out of the wound.

In separating these adhesions it is always necessary to exercise the greatest care, because occasionally a small abscess may remain for a considerable period of time after an acute attack of appendicitis, and if the appendix is peeled out carelessly it is very possible for the pus to come in contact with other parts of the peritoneal cavity and a peritonitis may then occur. Again, a perforation into the cæcum, or the ileum, may have occurred during the acute attack and the communication between the lumen of the appendix and the intestine may not have healed entirely, and upon removing the appendix a small intestinal fistula may be left, which again may become the cause of a peritonitis. In case there is an attachment to the cæcum or ileum the surface from which the appendix has been removed should be covered at once by means of a few Lembert sutures.

Again it may happen that the lumen of the appendix at its cæcal end is occluded and that the sac which is thus formed is filled with pus. Unless great care is exercised in dissecting the appendix out of its adhesions it is liable to perforate during the operation and cause an infection.

None of these complications have occurred in the case before us and we now have the cæcum and the appendix outside the ab-

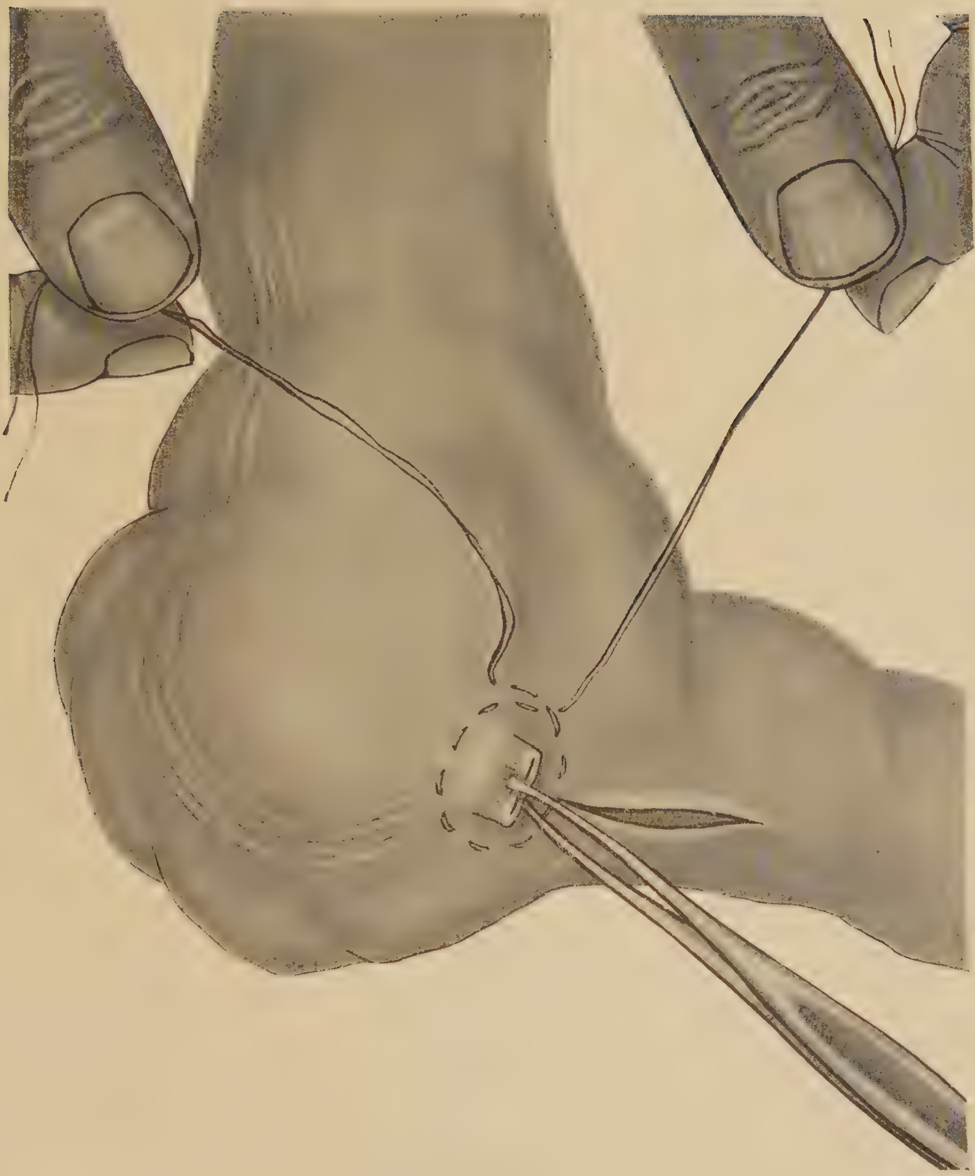


PLATE XVIII.

Caecum with Appendix Removed.

Represents the end of the cæcum after the appendix has been cut away, the remaining portion showing the effects of the pressure from the clamp. The figure should show the mesenteriolum ligated and cut, instead of showing a slit in the peritoneum, covering the cæcal end of the ileum.

dominal cavity without having caused any serious disturbance. The removal of the appendix will now be accomplished as illustrated in Plate XVII. (1) First a pair of forceps is applied to the mesentery of the appendix. (2) The mesentery is severed between the appendix and the forceps. (3) A second pair of forceps is applied to the appendix at the point of its origin from the cæcum. (4) The mesentery of the appendix is ligated and the forceps holding this structure is removed. (5) A purse-string stitch is applied from one-eighth to one-fourth of an inch from the base of the appendix. All of these steps are shown in Plate XVII, although in practice the forceps on the mesentery is removed before the purse-string suture is applied. The presence of the forceps on the appendix facilitates the application of the purse-string suture and at the same time acts after the fashion of an angiotribe crushing the tissues of the appendix into a thin layer, as shown in Plate XVIII.

The appendix is now cut away even with the forceps, care being taken to prevent leakage by applying another pair of forceps half an inch nearer the distal end of the appendix before cutting it away. The crushed stump of the appendix is then grasped by a pair of smooth dissecting forceps, as shown in Plate XVIII, and inverted into the cæcum while an assistant draws the circular stitch tightly, thus closing the defect, as shown in Plate XIX. The defects caused by the removal of the appendix are then covered with peritoneum by means of a few sutures and then a few more sutures are applied to cover the space occupied by the purse-string suture, as shown in Plate XX. It is not always that these last stitches are essential, but a little too much care is excusable, so long as it is harmless.

It does not matter whether fine silk or fine catgut be employed for these sutures, but in my own practice fine silk is used for all sutures applied to the intestinal walls. As a matter of convenience I use an ordinary straight sewing needle with the fine silk double, in order to prevent twisting and unthreading, because I can apply the sutures more rapidly in this way than by sewing with a single thread.

The entire field of operation is carefully inspected once more and if any abrasion is found this is covered with a few Lembert sutures, then the intestine is dropped into the peritoneal cavity and the abdominal wound is closed in the following manner:

The peritoneum and transversalis fascia are first united by means of a continuous catgut suture, as shown in Plate XXI. In this part of the abdominal wall the transversalis fascia is strong and is sometimes likely to retract so that it is is quite liable to be overlooked. As this error would weaken the abdominal wall quite a little at this point, it is well to bring both the peritoneum and the transversalis fascia together carefully with this suture.

The edges of the internal oblique abdominal muscle fall in apposition spontaneously as soon as the peritoneum and transversalis fascia have been sutured and without any further interference there would probably be a perfect union in the layer. To insure this still more fully, however, we apply one or two, or even three, interrupted catgut sutures through this muscle, as shown in Plate XXII. It is important to tie these sutures very loosely, as pressure necrosis in this position would result in retraction of the muscle and this would, of course, produce a marked weakening of the abdominal wall at this point.

The edges of the wound in the external oblique abdominal muscle and fascia have been held apart by means of retractors, in order to expose the internal oblique thoroughly. These retractors are now removed and immediately the edges of the muscle and fascia approach each other. With this natural tendency of the edges in wounds of these two muscles to approximate themselves without the use of sutures, there need be no fear of the formation of a post-operative hernia, because these two strong layers extend at right angles with each other.

The edges of the wound in the external oblique abdominal muscle are now united, as illustrated in Plate XXIII, care being again exercised not to draw the stitches too tightly for the reason given above.

In the three plates just referred to deep silkworm gut sutures are figured as placed in position, but not tied. These may be used if desired and tied after the buried sutures have been applied, but they are not necessary to secure a perfect union. In Plate XXIV these stitches are figured as having been tied and the skin is being united by means of a continuous, buttonhole stitch of horsehair. The latter is again used double, in order to prevent unthreading of the needle. It does not matter what form of stitch, or what ma-

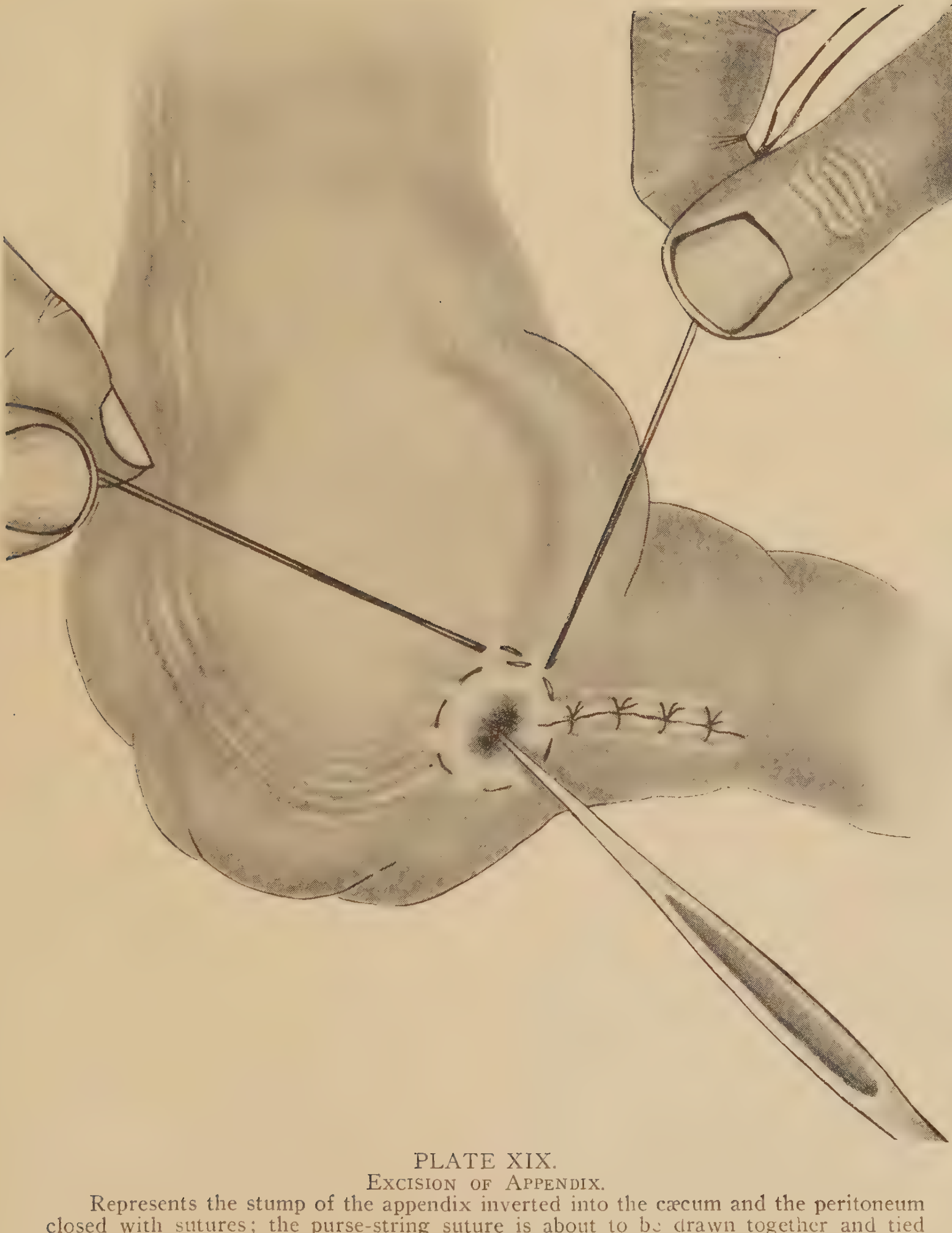


PLATE XIX.

Excision of Appendix.

Represents the stump of the appendix inverted into the cæcum and the peritoneum closed with sutures; the purse-string suture is about to be drawn together and tied to bury the stump of the appendix.

terial is used, for the coaptation of the skin so long as the material is aseptic. A dressing of aseptic gauze is applied to the surface and held in place with broad rubber adhesive plaster strips, in order to support the abdominal wall. This is covered with a sheet of sterile absorbent cotton which is held in place with an abdominal binder.

We will now examine the specimen we have removed in order to determine its pathological condition. The specimen is now a little over four inches in length, which is considerably less than it was before its removal, because the longitudinal muscle fibers have been contracted, and this has resulted in a marked shortening of the organ. Its mesentery is quite thick and extends a little beyond the end of the appendix. This condition has probably served to protect the organ against more extensive destruction, because in this way a fair blood supply has been insured to the entire organ, although locally it may have suffered severely. About one-half inch from its cæcal end there is quite a marked narrowing in its lumen, and by inspection and palpation we can determine the presence of a considerable amount of cicatricial tissue at this point. This is the point at which it was closely adherent to the lower end of the cæcum and it is likely that during one of the various acute attacks there was a perforation at this point. The narrowing is plainly shown in Plate XXV. Beyond this constriction we feel several hard masses in the lumen of the appendix which are undoubtedly due to fæcal concretions. Upon laying open the part, these concretions show, by the irregular forms into which they have been molded by the irregularities in the lumen of the appendix, that they must have been in this position for a considerable period of time. (Plate XXV.) The mucous lining of the appendix shows a number of cicatrices resulting from ulcers which have healed. and at the narrowest point, near the cæcum, the entire wall seems to be composed of cicatricial tissue, showing that there must have been at some time a complete destruction of a portion of the wall of the appendix. The lumen at this point is so small that a slight œdema would suffice to close it entirely, and with this closure would disappear the drainage of the cavity of the appendix. The septic material present in this lumen would, of course, increase very rapidly so soon as drainage had completely disappeared, and this would result in one of the recurrences from which this patient has suffered.

The digestive disturbances with which this patient has been afflicted can be explained, first, from the interference with the fæcal circulation because of the extensive adhesions drawing the intestines out of place; second, from the fact that the ileo-cæcal valve prevents the passage of gas and fæces when there is an irritation or inflammation in the appendix, and consequently the constant inflammation in this organ for a number of years resulted in an almost constant obstruction to the passage of gas and fæces from the ileum into the cæcum, and this, of course, resulted in digestive disturbances.

In many of these instances of chronic recurrent appendicitis it is much more difficult to remove the appendix than in this case, because it may be located in some position from which it can be dissected only with great difficulty. A not uncommon location is on the posterior surface of the cæcum. Here it is frequently completely covered with adhesions, as shown in Plate XXVI.

In these cases the end is universally club-shaped and filled with fæcal material, pus or mucus. Frequently there has been a perforation between the appendix and the cæcum, and occasionally there is a fistula which has persisted for a long time. The cæcum, together with the appendix, may be united by adhesions to the anterior surface of the iliacus muscle or to the omentum, or to both. The appendix may also be displaced very greatly. It has been found attached to the left of the median line, even to the border of the spleen. I have found it attached to each of the pelvic organs, uterus, bladder, ovaries, tubes, sigmoid flexure and rectum; also to the small intestines, to the anterior abdominal wall and to the gall bladder. Indeed, with a long, free cæcum there is no reason why the appendix should not be found attached to any point within the abdominal cavity.

Many times I have seen the appendix twisted upon itself like a snail and held in this position by adhesions, making the evacuation of its cavity practically impossible. In many cases there are several strong adhesions at various points in the course of the appendix, making short bends, which have a tendency to obstruct its lumen. The distal end of the appendix may project beyond the last one of these adhesions and form a free, sac-like projection.

It frequently happens that the strong adhesions are located

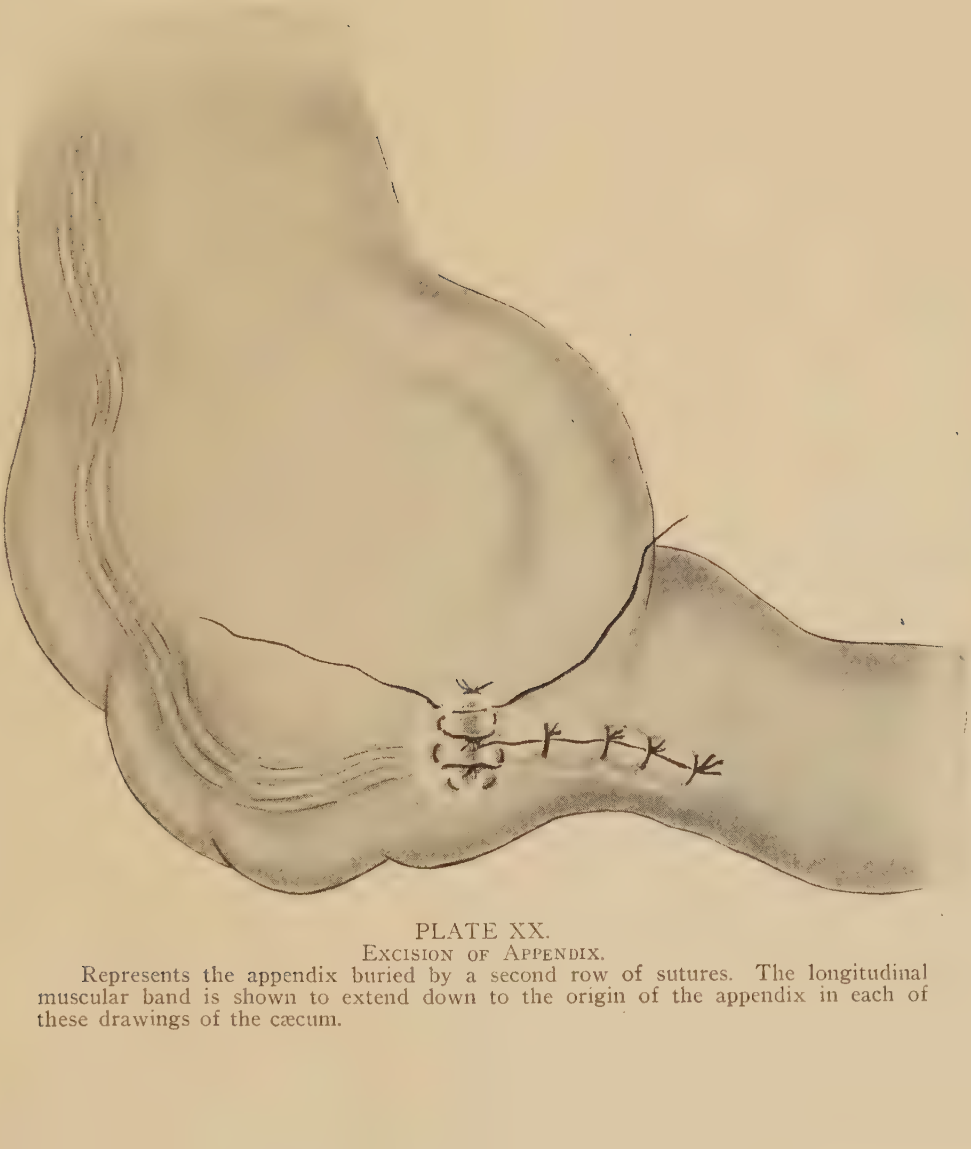


PLATE XX.

Excision of Appendix.

Represents the appendix buried by a second row of sutures. The longitudinal muscular band is shown to extend down to the origin of the appendix in each of these drawings of the cæcum.

opposite a point at which there was a perforation in the appendix during an acute attack. This will, of course, still further obstruct the lumen of the appendix at this point.

Plate XXVII represents an appendix which is fairly normal both at its cæcal and its distal end, but severely obstructed at three intervening points on account of short bends due to strong adhesions.

Occasionally an appendix is found in which the greater portion of the structure has been destroyed by gangrene and has been absorbed, leaving only a small, string-like structure along the edge of the mesentery of the appendix. Again, the cæcal end may have been destroyed in the same way, leaving the distal end without communication with the cæcum. This condition is likely to be troublesome because it leaves a sac lined with mucous membrane containing septic material without drainage into the cæcum.

In still other cases the appendix has become so intimately united with the posterior surface of the cæcum that it can be discovered only after the most careful search has been made, because both the appendix and the underlying cæcum are covered with a broad sheet of connective tissue which has almost perfectly the appearance of peritoneum. In these cases it frequently happens that the proximal end of the appendix is entirely occluded and that the distal end contains septic material which gives rise to the recurrent attacks of appendicitis, which subside only when the abscess formed has perforated into the cæcum.

The longitudinal band of muscle fibres serves better than any other guide to the discovery of the location of the appendix in these examples.

The operator may easily be deceived in searching for the appendix, in the interval in recurrent appendicitis, by the presence of a small mass of fat at the lower end of the cæcum. This may lead him to suppose that the appendix has been entirely destroyed on account of gangrene and that all that is left is simply the fat mesentery of the appendix. Careful inspection will usually show that this mass of fat consists of a small portion of omentum which has surrounded the appendix and has become thoroughly adherent to the latter or to its remnant after the portion destroyed by the disease has been absorbed. So long as the operator follows the longitudinal muscle band upon the anterior surface of the cæcum, and at the same time is as careful as possible not to injure the walls of the loops of intestine which may be adherent, his search for the appendix can be conducted with relative safety.

The important points to be borne in mind in connection with recurrent appendicitis are: 1, The patient's opportunities for professional or business prosperity are greatly limited by the frequent interruptions due to the disease. 2, He is deprived of many of the ordinary pleasures of life. 3, He is constantly in danger of suffering from a serious attack. 4, His digestion is impaired and his nutrition is correspondingly reduced. 5, He is forced to absorb septic material during a considerable portion of the time. 6, During any attack any of the various complications resulting from acute appendicitis may occur.

All of these conditions can be eliminated by an operation which in itself is not accompanied with as much danger as there is in any one attack of recurrent appendicitis, and which will confine the patient for a very short time, provided, always, that the operation is performed by a safe surgeon and after the acute attack has subsided completely.

ACUTE PERFORATIVE APPENDICITIS.

The patient before us is fourteen years of age, a school girl, slightly built, and not well developed for her age. She gives the following history: She has never been strong since infancy, which she attributes to the fact that she suffered from measles and scarlet fever while very young. Her nutrition has always been imperfect and her appetite unnatural, being either ravenous or entirely absent. Her bowels have been constipated and her abdomen bloated. She has menstruated since one year ago at irregular times and has suffered severely with pain in the region of the right ovary during each period. The pain has been spasmodic and so severe that the use of anodynes seemed necessary for her relief. She never suffered from severe pain at any other time, although she occasionally had slight attacks of colic in the epigastric region whenever she was especially careless about eating. Three days ago, immediately after a meal (an unsually large dinner) the patient suddenly experienced

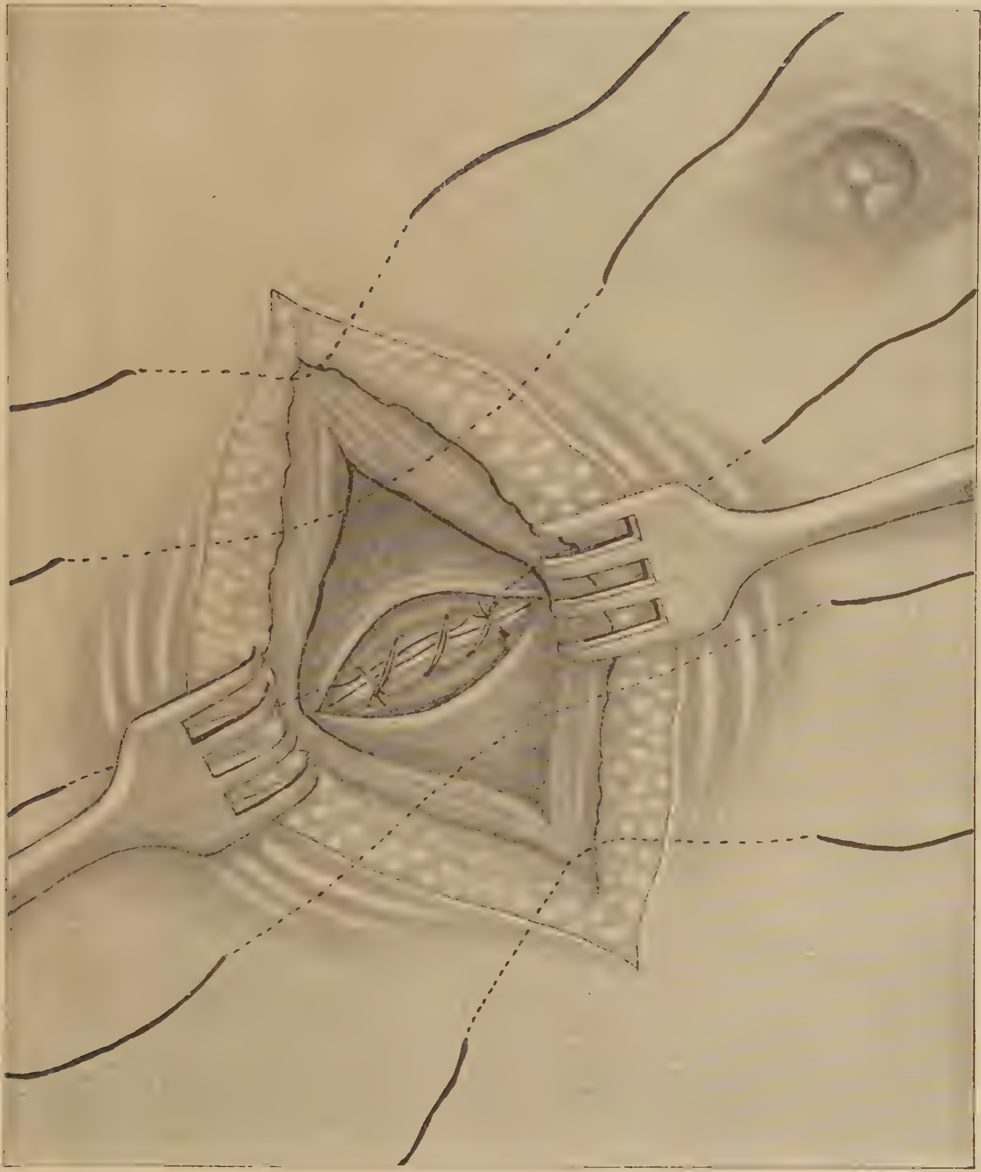


PLATE XXI.

McBurney's Incision.

Represents McBurney's incision for the removal of the vermiform appendix, the deep silkworm gut sutures are in place, but not tied, the peritoneum and transversalis fascia being united with a separate row of continuous cat-gut sutures; the internal oblique abdominal muscle being split with the edges still separated. The edges of the external oblique addominal muscle are held apart with retractors.

severe pain over the entire abdomen, but which was more severe in the vicinity of the umbilicus.

The patient was put to bed and hot cloths were applied to the abdomen, affording only very slight relief; she was then given a large dose of salts, followed by a cup of hot water. Being slightly nauseated before, this condition increased very rapidly, resulting in severe vomiting, which has persisted at intervals ever since. Two days ago she received several enemata, one of which was followed by the expulsion of gas and some fæces. The patient received soups and milk by mouth, but could not retain the nourishment more than a few hours at a time, when she would vomit whatever had been taken. All remedies given to relieve the nausea and vomiting were of no avail. Several further enemata were given without effecting the expulsion of gas or fæces. The abdomen became more and more tympanitic and the pain became so severe that morphia had to be given hypodermically. The pulse increased to 130 beats per minute and the temperature to 102.5°. The pain has become localized in the right inguinal region.

Present Condition.—The general appearance of the patient is extremely unsatisfactory. She gives the impression of one who is almost hopelessly ill. She has an anxious, restless expression. Her breathing is entirely costal, rapid and short. Her abdomen is severely distended and more prominent in the right inguinal region than in the left. The abdominal muscles are exceedingly tense, especially on the right side. The patient shrinks if she notices any one approaching the bed, although she seems too ill to show interest in anything else. The history I have given had to be elicited from her relatives.

Upon percussion we find a little difference in resonance in the two inguinal regions, but neither side gives a dull or a flat sound. The patient complains of pain from percussion on the right side.

Upon examination through the rectum we find this organ distended with gas above the internal sphincter, which is supposed to indicate the presence of diffuse peritonitis. On the right side the finger perceives a fullness, but no fluctuation. Her thighs are drawn up to relieve the tension of the abdominal muscles. The nurse has placed a pillow under her knees to make this position more comfortable. The patient's temperature is nearly 103° F. and the pulse 130 beats per minute and very feeble. Her tongue is thickly coated and the edges are red in small spots. She is intensely thirsty, but does not retain the liquid given to her.

DIAGNOSIS.—The patient is evidently suffering from acute perforative appendicitis with beginning diffuse peritonitis. This may be due to the perforation of an ulcer which has existed for a considerable period of time, or to gangrene of the appendix, due to the thrombosis of some of its vessels or to the perforation of an appendix distended with pus with its cæcal end occluded by the cicatricial tissue. The patient is extremely ill, and it is plain that unless the method of treatment employed during the past three days is radically changed she cannot survive long.

TREATMENT.—So far the patient has received the treatment prescribed by many of the leading text-books on internal medicine. She has been limited to liquid diet, has received saline cathartics and enemata, has had hot applications to the abdomen, and when the pain has been unbearable opium was employed only in sufficient doses to overcome the severe distress.

There can be no doubt from the progress of the disease that such treatment was extremely unfortunate in this case. I believe that this form of treatment should be condemned in every case of acute appendicitis, because it contains nothing which can be useful for the relief of the pathological conditions present, while it contains many features which are extremely harmful, as we will see presently.

The question arises, What can we do for this patient that will be of greater benefit to her and may possibly rescue her from the present apparently hopeless condition?

Many authors advise an immediate operation in all cases of acute appendicitis without regard to the condition of the patient or the stage of the attack, unless the patient is moribund on the one hand or improving rapidly under the treatment which is being employed at the time the surgeon is called. Although this patient is very ill, she is not moribund, consequently this case would come under the class in which an immediate operation is advised by these authorities. In my own experience, and in the experience of all

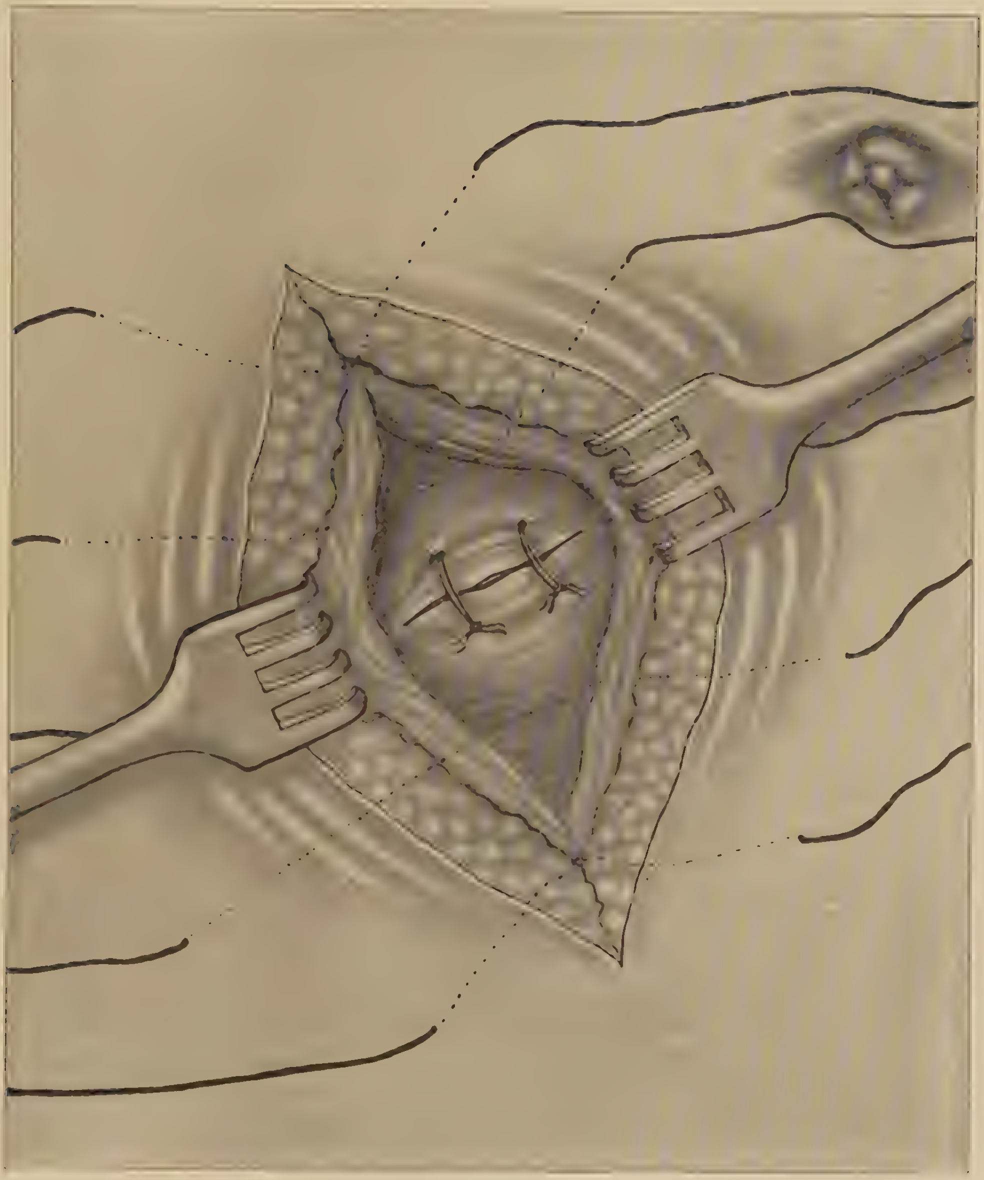


PLATE XXII.
ABDOMINAL WOUND.

Represents the next step in the closure of McBurney's incision, the internal oblique abdominal muscle having been united with interrupted cat-gut sutures.

surgeons whose work I have had an opportunity to observe, patients with the conditions of the case before us have almost invariably died within twenty-four or forty-eight hours after an operation. These cases belong to a class in which operative treatment has an especially high mortality. In fact, by far the greater portion of all fatal cases following appendicitis operations belong to this class. These cases have been said to be too late for an early, and too early for a late operation.

My experience has been quite different with a form of treatment which we will proceed to employ in this case. Of course, no form of treatment can save every case of perforative appendicitis, especially if the patient has received cathartics and food by mouth before he comes under our care, but in cases like the one before us I would estimate the proportion of recoveries at about ninety per cent. if the method which we will use in this case be employed.

Had it been possible from the beginning to confine the septic material to the vicinity of the appendix, the patient's condition would never have become as serious as we find it at the present time, because her serious condition is undoubtedly due to the fact that the septic material has been distributed over a considerable portion of the peritoneum.

In order to comprehend fully the treatment I will advise in this case, it will be necessary to direct attention to the anatomical location of the appendix.

The appendix is virtually surrounded on all sides, excepting in the direction of the median line, by relatively fixed tissues. Above we find the lower end of the cæcum and the cæcal end of the ileum; to the right and in front is the parietal peritoneum; behind the peritoneum covering the iliacus muscle; and toward the median line it is surrounded by loops of small intestines. Moreover, the omentum extends far beyond its lower end.

It is true that the appendix may be displaced downward, but in this case it will again be surrounded by fixed tissues which seem especially adapted to dispose of septic material. Again, in this case there is an enteroptosis affecting the cæcum, and always with this a marked lowering of the transverse colon and stomach, and with these the omentum.

Thus we see that the natural anatomical arrangement for the protection of the general peritoneal cavity is extremely efficient. There is but one weak point in the anatomical provision for this protection, namely, in the direction of the median line, because the great mobility of the small intestines naturally favors the distribution of septic material to all parts of the peritoneal cavity. If we can prevent the small intestines from doing harm in this direction, we will have accomplished our end, theoretically at least.

At this juncture I wish to direct attention to another important anatomical condition. The blood supply of the omentum is so enormous that it will readily dispose of a very severe infection by walling off the surrounding structures if it is permitted to give its physiological attention to a single area.

It is a well-known fact, which every one who frequently operates during the acute attack of appendicitis has had many opportunities to observe, that the omentum crowds itself about any inflammatory or traumatic lesion within the peritoneal cavity the moment such lesion occurs, and if left undisturbed a few hours will suffice to cause efficient protective adhesions.

These adhesions become stronger every hour and the blood supply in the omentum becomes greater, so that if no disturbance arises one can reasonably expect efficient protection to the general peritoneal cavity from the omentum.

Another important fact must not be lost sight of in this connection, viz., that the surrounding structures being relatively fixed in position favor the condition of rest of the inflamed part and permit the omentum to act after the manner of a splint applied to an inflamed joint. The value of rest as a preventive to the extension of an infection in any part of the body cannot be overestimated. Consequently, if it is possible for us to secure this condition of rest we have gained another important point in the right direction.

In case the appendix is displaced upwards its position is even more favorable, because the available amount of omentum is thus increased. Again, if the appendix is retro-cæcal in its position, which is very frequently the case, the infection of the general peritoneal cavity is more easily prevented than when in its normal location. If anteriorly misplaced it is likely to be fastened to the anterior abdominal wall by the adherent omentum.

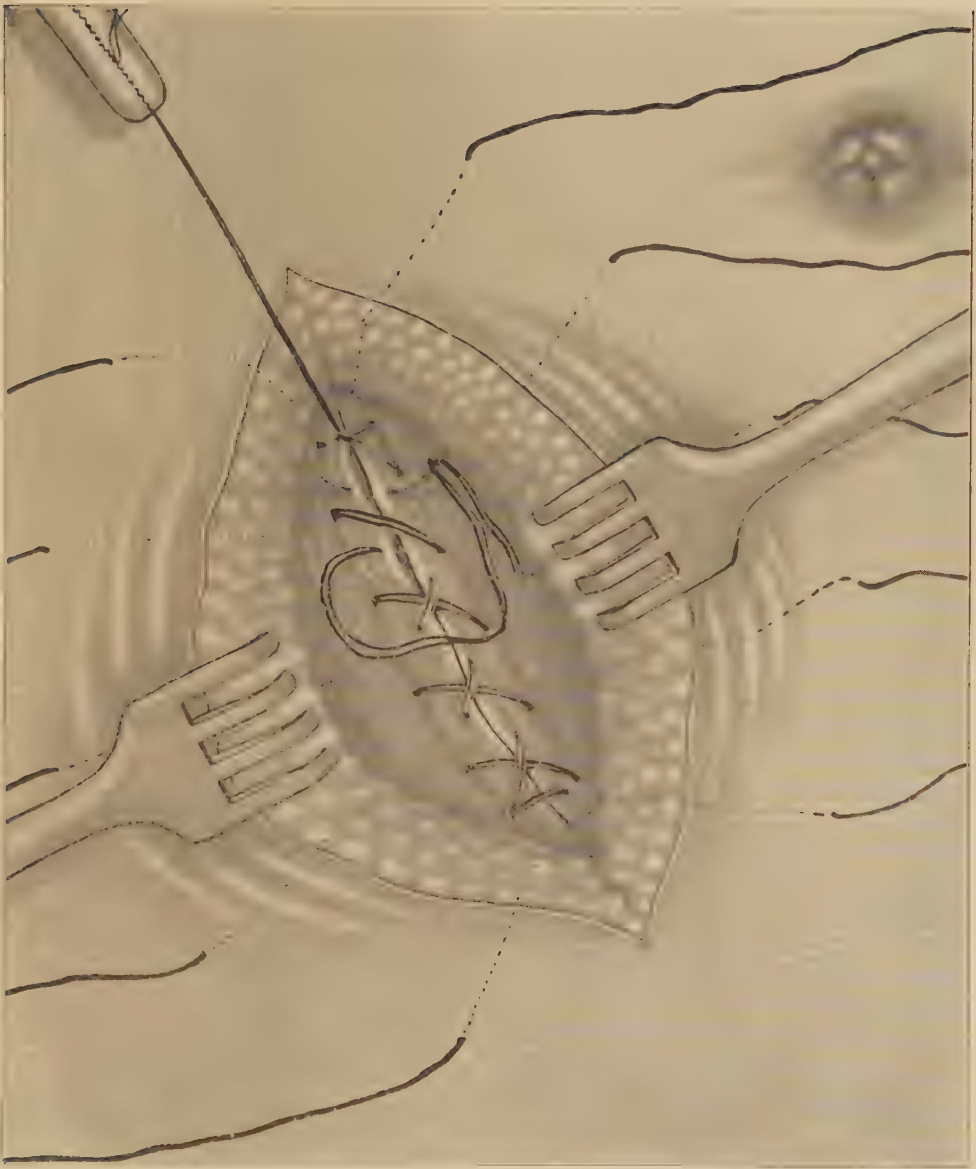


PLATE XXIII

Abdominal Wound.

Represents the next step in the closure of McBurney's incision, the fascia of the internal oblique abdominal muscle having been united with a continuous cat gut suture

Peristaltic Motion of the Small Intestines.—It is plain, then, that the infection of the general peritoneal cavity must occur from a disturbance on the part of the small intestines and must be due to their peristaltic motion.

It is significant that in almost all cases of severe, acute appendicitis the obstruction to the passage of gas and intestinal contents through the ileo-cæcal valve is one of the early symptoms, a condition which was present throughout the attack in the case before us. Nature is trying to prevent this very dangerous disturbance by closure of the ileo-cæcal valve. We have a condition corresponding to the contraction of the muscles surrounding an inflamed joint, to the closure of the eye-lids in conjunctivitis, etc. Moreover, the muscles overlying the appendix become tense. Everything tends toward the establishment of conditions of rest in the vicinity of the inflamed organ.

The Effect of the Introduction of any Kind of Food or Cathartic into the Stomach.—It is a fact which has been demonstrated a great number of times that peristalsis does not occur unless food or cathartics are introduced into the stomach. If the attack occurs shortly after a meal and before all of the food has passed through the ileo-cæcal valve, its presence may cause peristaltic motion in the small intestines. Upon reaching the ileo-cæcal valve the latter may prevent its passage into the cæcum, causing return peristalsis, and the intestinal contents are forced back into the stomach, from whence to be expelled by vomiting or be again forced into the small intestine, giving rise to further peristaltic motion. Moreover, it will give rise to the formation of gas, which must cause disturbance and pain in its attempt to pass the ileo-cæcal valve.

This motion, it is plain, will be harmful primarily from the fact that it gives rise to pain by disturbing the sensitive, inflamed tissues; and, secondarily, from its likelihood of carrying infectious material, with which it has come in contact in the vicinity of the inflamed appendix, to other parts of the peritoneal cavity.

Besides this the physiological attention of the omentum cannot be directed to the single area of infection, because other parts of the peritoneal cavity require its protection, and such portions of the omentum as are not yet thoroughly adherent about the inflamed appendix are inclined to be diverted from this point.

Theoretically, then, the disturbance which is to be feared to so great an extent is caused by the presence of food or cathartics in the stomach, and its logical remedy would be to absolutely prevent the introduction of any form of food or cathartics into the stomach and the removal by gastric lavage of any portion of food that may be retained in the stomach at the beginning of the attack. It may be necessary to perform gastric lavage twice, or at most three times, in order to entirely remove remnants of food which may have regurgitated into the stomach from the small intestines by reason of return peristalsis. That this is not only true theoretically, but also in practice, I have demonstrated in a large number of cases; and many other surgeons who have followed the same plan of treatment have informed me of the fact that their experience has agreed with mine.

It is true that a few surgeons have reported failures with this method, but an investigation of their treatment in each instance has shown that they disregarded one of the three cardinal points in the treatment. They either gave just a little liquid food by mouth, or they gave some form of cathartic, or disturbed the rest of the intestines by giving large enemata, or they neglected removing the stomach contents by gastric lavage.

Of course, the slightest amount of food is sufficient to start peristaltic motion of the small intestines, and the same is true of cathartics, and consequently if either of these features in the treatment be omitted one cannot hope for the same results.

It seems clear that this form of treatment must be useful, in any given case, no matter what form of appendicitis may be present, because in the milder cases it will result in rest of the affected part, and consequently rapid resolution; in the severe cases it will guard against mechanical distribution of infectious material; and in all cases it reduces the tendency to meteorism and stops the pain.

There is, however, one class of patients in which I have found this treatment of the greatest value. I refer to the class in which the appendix is gangrenous or perforated and in which there is already a beginning general peritonitis. These patients give the impression of being profoundly ill. There is complete obstruction to the passage of gas or fæces. There is nausea or vomiting and marked meteorism; the pulse is small and quick; usually there is

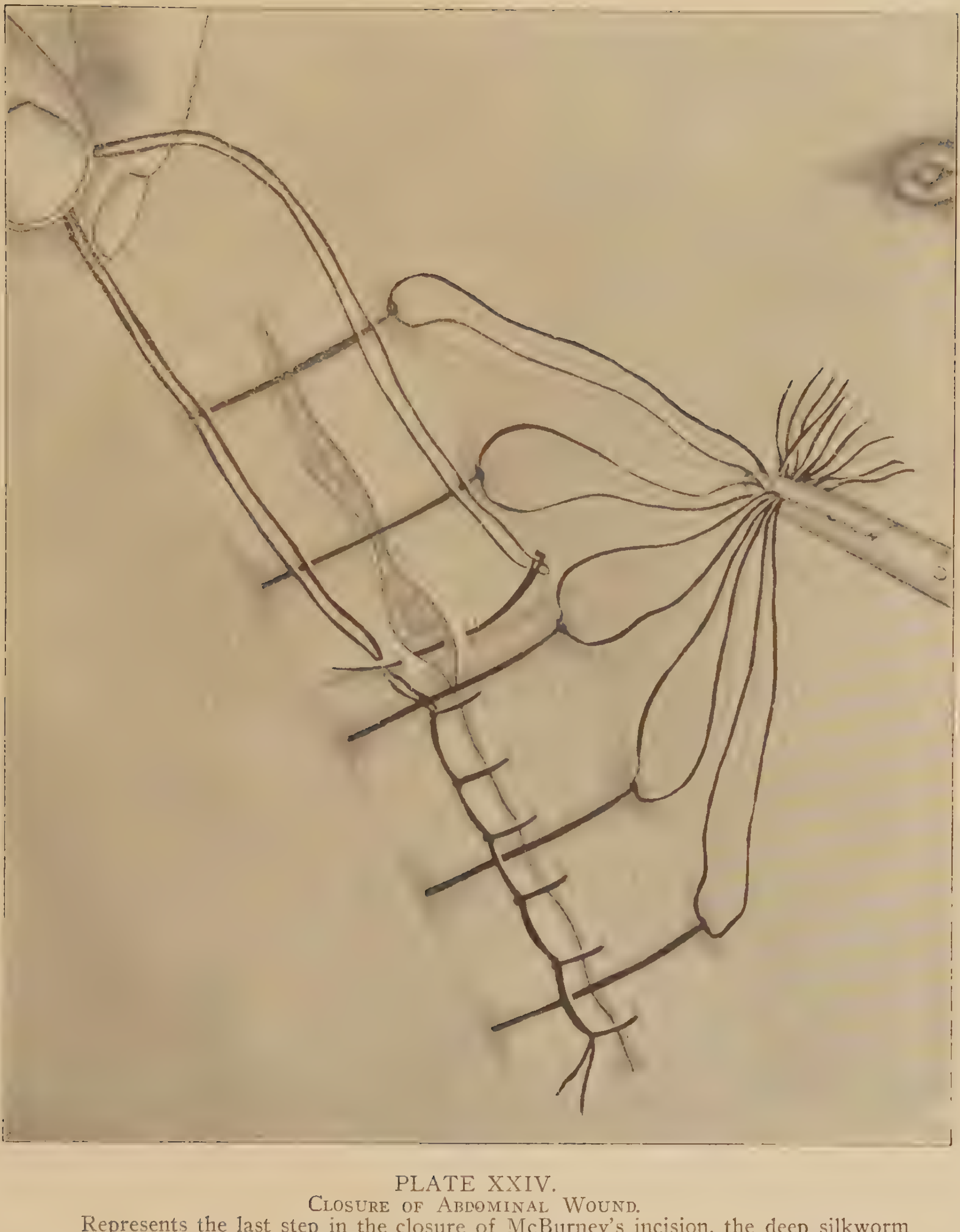


PLATE XXIV.

CLOSURE OF ABDOMINAL WOUND.

Represents the last step in the closure of McBurney's incision, the deep silkworm gut sutures and the coaptation sutures for the skin having been applied.

high fever, but the temperature may be subnormal; respiration is rapid, superficial and costal, and the abdominal muscles overlying the appendix are tense—conditions corresponding to those we have just observed. The patient is in a state in which I formerly operated at once, day or night, as a last resort, only to find that it was too late in more than one-third of the number of cases, the mortality increasing with the time that had elapsed since the beginning of the attack. In this class of cases there is still a recovery of over ninety per cent. if the principles laid down above be thoroughly applied.

If peritonitis is absolutely inhibited, as it can be, the infection will still become circumscribed and the pus can be evacuated with safety. Moreover, the condition I have just described is in itself the result of the administration of food and cathartics. Had these patients received neither food nor cathartics from the beginning of their attack, the affair would never have advanced to this dangerous point. This refers particularly to a class of cases which Richardson has so well described as being "too late for an early, and too early for a late, operation."

If the plan I have outlined above is carried out in this case, the following changes are quite certain to occur: The nausea and vomiting will cease after one or two, or at most three, gastric irrigations. The meteorism and the pain will decrease greatly during the first twelve hours and will almost completely disappear in twenty-four hours. The pulse will become slower and firmer and more regular; the breathing deeper and the patient's general appearance will improve to an astonishing extent. The temperature will go below 100° F. the first twenty-four hours, and in three days it will be practically normal. The abdominal muscles will become soft as soon as the stomach contents have been removed by gastric lavage.

Usually the improvement is so rapid that one is tempted to spoil everything by giving nourishment by mouth, because the patient's condition does not seem serious enough to warrant such severe deprivation measures.

That this form of treatment—which I have employed since 1892, at first only in selected cases and later more and more generally—is really of great value is shown by clinical results. My mortality in cases of perforative or gangrenous appendicitis with beginning diffuse peritonitis is less than one-fourth as high as it was in the cases operated at once upon making the diagnosis, and even in advanced cases of diffuse peritonitis there has been a marked decrease in the mortality in my experience.

It might be said that these cases were not due to perforative or gangrenous appendicitis, but that they were simply severe catarrhal cases, which are known to result favorably under any form of treatment. To this I would respond that I have later removed the appendix in many of these cases and have almost invariably demonstrated the correctness of the diagnosis; and in the case before us we will undoubtedly have an opportunity to demonstrate the fact that she is suffering from a perforative appendicitis when we operate upon her after the acute attack has subsided.

It might seem impossible to remove more substance from the stomach of this patient after she has vomited so frequently for a period of more than two days. Frequently physicians have considered this step superfluous, because they have imagined that the stomach must surely be empty under these conditions. This is, however, a very serious error. The fact that the patient is suffering from nausea or vomiting is the strongest indication for the use of gastric lavage, because the nausea is caused by the presence of decomposing material in the stomach and its removal must result in the greatest benefit to the patient. It frequently happens that these patients lose their anxious expression and restlessness, which we have observed in this case, and that the skin becomes warm and moist and they begin to sleep directly after the gastric lavage has been practised.

Were a person in perfect health to place in his stomach the amount of decomposing food and mucus which we have just washed out of the child's stomach, he would at once become violently ill, and consequently the effect of this substance upon a patient whose strength has been exhausted by a severe acute illness must certainly be still worse. It is possible that there may be more material of the same character in the small intestines, but if so it will soon regurgitate into the stomach and make its presence known by the recurrence of nausea. Should this occur the gastric lavage will be repeated at once. If no food is given by mouth I

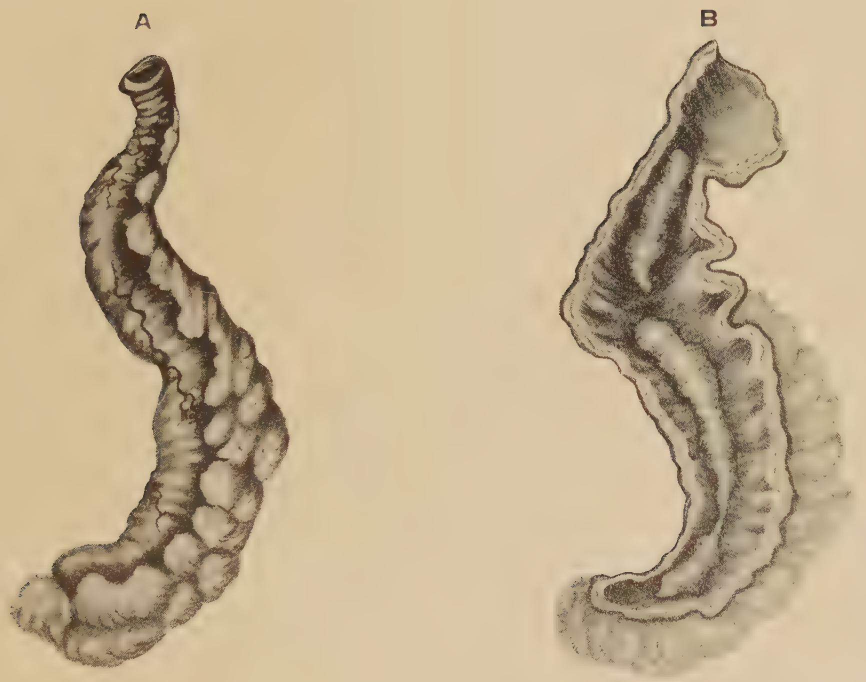


PLATE XXV.

CONSTRICTED APPENDIX.

Represents the vermiform appendix with a constriction near its cæcal end. The mesenteriolum extends a little beyond the end of the appendix. The latter is markedly œdematous. Fig. B represents it laid open, showing fæcal concretions in its lumen, and also showing the constriction near its cæcal end.

have never been compelled to irrigate the stomach more than three times in the same patient, and usually one careful, thorough irrigation will suffice. It will be wise to direct attention to the method employed in such cases. The patient is turned upon the right side in order to add the weight of the intestines to the support of any adhesions which may exist in the vicinity of the appendix. The head and shoulders are slightly elevated by means of pillows or a head-rest, then the pharynx is sprayed with a four per cent. solution of cocain in order to prevent gagging when the stomach tube is passed, because this might disturb the adhesions in the vicinity of the appendix. It is well to spray the pharynx repeatedly for a period of about five minutes, permitting the patient to swallow a little of the saliva mixed with cocain in order to anæsthetize the œsophagus to some extent at the same time. After holding the cocain in the pharynx a minute it is expectorated with the saliva which has accumulated and a fresh spray is applied. As most of the cocain is thus thrown out there is no danger from poisoning. After about five minutes a fairly large stomach tube is inserted and the contents of the stomach siphoned out. The stomach tube should have one or two lateral openings aside from the opening at its end. These openings should be within one to two inches from the end which is inserted in the stomach. This will prevent the end of the tube from becoming closed by drawing into it a portion of the mucous lining of the stomach.

Whenever there is any interruption in the flow this may be overcome by pouring a little water into the tube and thus dislodging any substance which may have become fixed therein.

After the accumulation which is present in the stomach has been siphoned out it is well to introduce into the stomach a pint of normal salt solution at 100°F. and then siphon it out. This may be repeated until the fluid returns clear.

The patient will now be placed in bed with the shoulders somewhat elevated so as to favor gravitation toward the pelvis. She will receive absolutely no food and no cathartics by mouth. Every four hours she will receive an enema of an ounce of one of the concentrated predigested foods dissolved in three ounces of normal salt solution. I am confident that she will not require any anodyne, her pain will disappear spontaneously since we have removed the cause of irritation by performing gastric lavage. In the meantime we will observe the patient carefully, because it is quite possible that a circumscribed abscess will develop in the right inguinal region. If this should occur we will simply drain the abscess. It is surprising to observe how much infection will be disposed of by the peritoneum and the omentum and how extensive an infection of the peritoneum will subside completely if one will only secure a condition of rest to the small intestines and will thus prevent the further infection of the portions of the peritoneum away from the point of primary infection in the vicinity of the vermiform appendix.

There are two classes of patients in whom this form of treatment is not so satisfactory as it is in all other classes, namely, the very old and the very young. Very old patients do not bear confinement in bed well, no matter what their condition may be, and they do not prosper generally on rectal feeding. In these cases one is compelled to choose between two evils, and whichever is chosen one usually wishes it had been the other.

In children it is difficult to perform gastric lavage, they are likely to struggle and injure themselves while this is being accomplished. The same is true of administering rectal feeding. Moreover, the omentum in small children is not sufficiently developed to act as an efficient protection. It is consequently wise in these two classes to operate whenever the patient's condition indicates that he will probably recover from the operation.

After the patient has recovered from the acute attack, which can be determined from finding the temperature and pulse normal, the diminished rigidity of the abdominal wall, pain and tenderness upon pressure absent, the obstruction to the passage of gas and fæces relieved, feeding by mouth may be commenced gradually. It is well to give a small cup of beef tea made from some of the commercial beef extracts every three hours at first, because this will serve to encourage the patient, while it will not give rise to peristaltic motion because it is absorbed from the stomach, being composed almost entirely of non-irritating soluble substances. Later milk and lime-water, soups, broths and gruels may be given.

I believe that it is well not to operate in these cases, after they have recovered from the acute attack, until they are in a condition

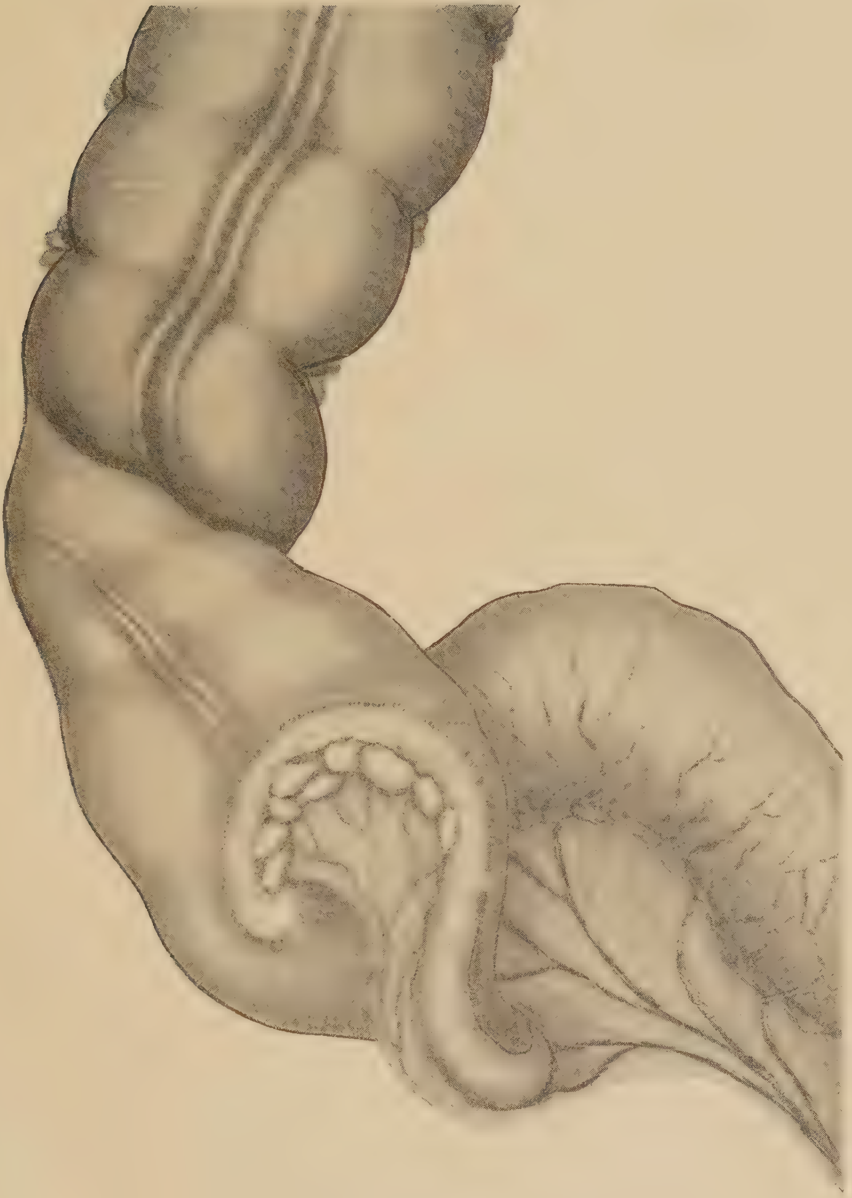


PLATE XXVI.

Adherent Appendix.

Represents the cæcum together with the ileum and the mesentery of the latter. The appendix is bent upon itself in the form of an interrogation point. It is strongly attached by adhesions to the lower end of the cæcum. The lymph glands in its mesentery are greatly enlarged.

in which it seems perfectly safe to give the ordinary dose of castor oil which we are in the habit of administering in preparing patients for abdominal operations. Of course this should not be given so long as there is any doubt regarding the complete recovery, because if given too early it might be the cause of recurrence. If the oil causes no disturbance it is fair to suppose that the patient has fully recovered from the acute attack and is in a favorable condition for obtaining radical relief.

I believe that my clinical experience in the treatment of cases belonging to the class represented by the case under consideration warrants the following conclusions in connection with the plan of treatment I have just advised.

1. Peristaltic motion of the small intestines is the chief means of carrying the infection from the perforated or gangrenous appendix to the other portions of the peritoneum, changing a circumscribed into a general peritonitis.

2. This can be prevented by prohibiting the use of every kind of food and cathartic by mouth, and by employing gastric lavage in every case in which there are remnants of food in the stomach or in the intestines above the ileo-cæcal valve, as indicated by the presence of nausea, vomiting or meteorism.

3. The patient can be supported by the use of concentrated predigested food administered as enemata not oftener than once in four hours and not in larger quantities than four ounces at a time.

4. This form of treatment, when instituted early, will change the most violent and dangerous form of acute perforative or gangrenous appendicitis into a comparatively mild and harmless form.

5. Cases of perforative or gangrenous appendicitis, with beginning general peritonitis, can usually be carried through the acute attack safely with this method.

6. In all cases of this class gastric lavage should be practised in order to prevent the absorption of decomposing material from the alimentary canal.

7. In cases of doubtful diagnosis this form of treatment should always be employed.

8. This treatment will prevent a large proportion of the most troublesome complications and sequelæ of appendicitis, such as ventral hernia, fæcal fistulæ, extensive adhesions, etc.

9. The patient should be permitted to recover fully from his acute attack before an operation is performed, except in cases encountered within the first thirty-six hours after the beginning of an attack or in case of the formation of a superficial circumscribed abscess.

10. It often requires but a small amount of any kind of food to change a harmless circumscribed into a dangerous diffuse peritonitis.

11. The treatment does not protect the patient against a subsequent attack.

12. It does not contra-indicate the removal of a diseased appendix before the septic material has extended beyond this organ.

13. It is indicated in all intra-abdominal conditions in which it is desirable to prevent the distribution of septic material by means of peristaltic motion.

14. The laity should be taught to stop feeding and giving cathartics to patients suffering from intra-abdominal diseases.

ACUTE GANGRENOUS APPENDICITIS.

This patient, twenty-seven years of age, a book-keeper by occupation, came under my care one hour ago. He was then in his residence, a distance of two miles from the hospital, where I saw him in consultation with his physician, who had made the proper diagnosis before he requested me to see the patient with him. The patient gives the following history:

Family history good. As a child he had suffered from measles, but was otherwise well. About one year ago the patient suffered an attack of pain in the right inguinal region, accompanied by vomiting and fever, and was confined to bed for about one week. Has been more or less constipated during the past year and has had more or less weakness and pain in the right inguinal region. This was always worse after having eaten heavily. One week ago he had a severe attack of pain, accompanied by vomiting and a slight amount of fever. He was confined to bed for three days. For the following four days he was up and about, and was fairly well this morning when he felt a slight pain before rising. He ate breakfast and at about ten o'clock was seized with most violent

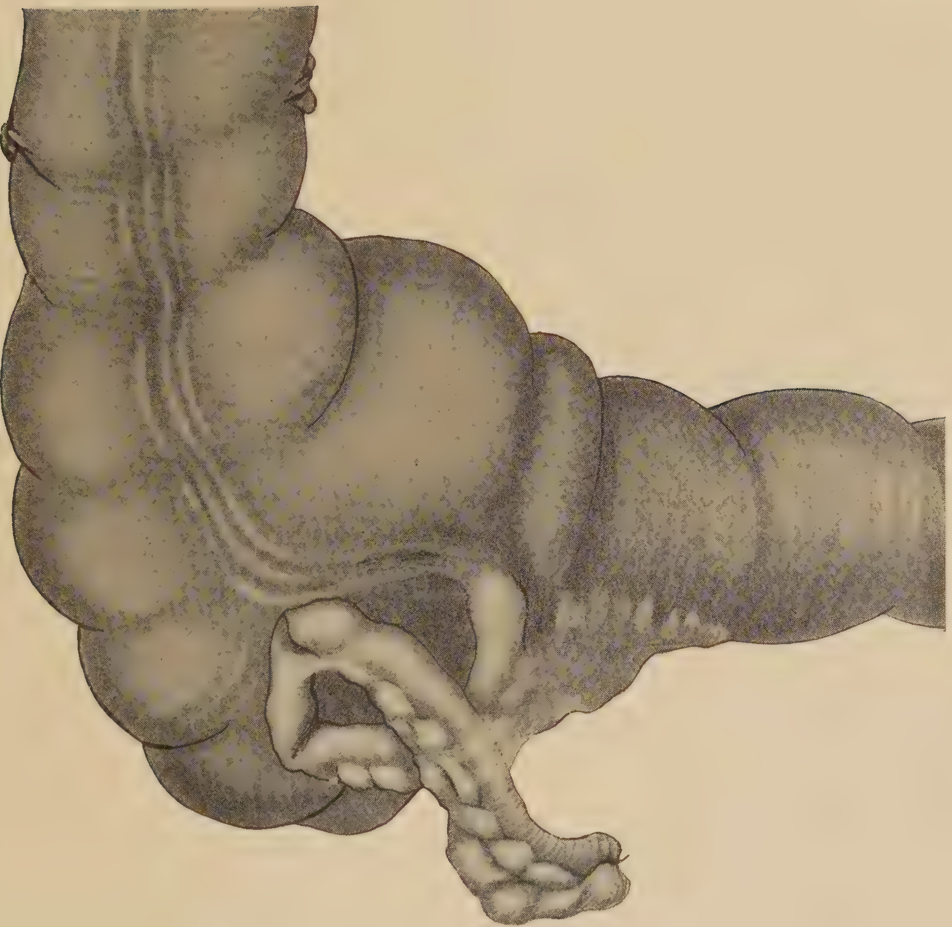


PLATE XXVII.

ADHERENT APPENDIX.

Represents the vermiform appendix bent upon itself, making several sharp angles, held in position upon the lower end of the cæcum by strong adhesions, one of the latter extending over upon the ileum. The end of the appendix is free. The mesenteriolum is narrow, but it extends to the end of the appendix.

distress in the right inguinal region, accompanied by vomiting, chills and fever. The patient suffers from severe shock, is still suffering severe pain in the right inguinal region, although he received a hypodermic injection of one-half grain of morphia before coming to the hospital. In the region of McBurney's point there is great tenderness and the muscles are extremely rigid. His temperature is 100 degrees F. and pulse 102. There is no tumor palpable.

DIAGNOSIS.—We have here again a fairly typical condition. A history of a previous acute attack of pain in the right inguinal region, accompanied with vomiting and fever, which must have been sufficiently severe to leave the appendix somewhat impaired. It was not severe enough to warrant a diagnosis of gangrenous or perforative appendicitis, but it might have been due to an obstruction to the lumen of the appendix, resulting from the presence of an enterolith or an ulcer in the cæcal end of the appendix. The slight attack a week ago might have been a repetition of the same condition.

At the present moment the patient is still suffering, but not nearly so much as one hour ago when I saw him in his residence, where he was fairly in convulsions because of the extreme pain in the region of McBurney's point. The large dose of morphia he received before coming to the hospital serves to disguise the condition somewhat. This, however, does not matter, because there can be no doubt concerning the diagnosis.

The extreme violence of the attack which occurred about ten hours ago and which has not subsided since; the increase in his temperature; the acceleration of his pulse and the bad appearance of the patient; the great rigidity of his abdominal muscles; the obstruction to the passage of gas, all go to show that the patient is suffering from a gangrenous appendicitis, or an impending perforation due to pressure from an enterolith or the accumulation of pus in an obstructed ulcerated appendix.

TREATMENT.—Only two forms of treatment can be considered in a case of this character: 1. Immediate operation. 2. Palliative treatment according to the method employed in the previous case by means of exclusive rectal alimentation and consequent elimination of peristalsis.

Judging from the history in this case and from the conditions we find upon examination it is reasonable to suppose that at the present time, only ten hours after the beginning of the attack, the infectious material is still confined to the appendix.

The following advantages can be brought forward in favor of an immediate operation in cases like the one before us:

1. The patient will almost invariably get well; it is an accident if he does not recover. 2. He will be able to return to work in one month. 3. He cannot have a recurrence. 4. He cannot have the complications resulting from progressive or metastatic infection. 5. There will be no adhesions with their digestive disturbances. 6. There will be no ventral hernia because drainage will not be required.

It is quite different one or two or three days later when the infection has extended to the tissues beyond the appendix, for the following reasons: 1. The patient is not certain to recover, even in the hands of the most skillful surgeons. 2. His recovery from the operation is likely to be slow. 3. It may not be safe to remove the appendix after opening the abdomen, hence a recurrence may still occur. 4. The operation may cause an extension of the infection. 5. Adhesions are likely to follow the operation performed at this time because drainage will probably be required. 6. For the same reason hernia frequently occurs after operations performed at this period.

What can we expect in case the patient is not operated immediately, but treated by the method described in the preceding case?

In cases like the one before us, in which I have been compelled to employ this method because the patient or his friends absolutely refused an operation, I have found the pain subside rapidly after applying gastric lavage and that the other symptoms decline within twenty-four or forty-eight hours or at the latest seventy-two hours, with the exception of the tenderness upon pressure. In some cases a circumscribed abscess formed, which had to be opened externally or it ruptured into the cæcum. If I was permitted to remove the appendix later it would be found eliminated from the general peritoneal cavity by means of adhesions to the omentum, the cæcum or the iliacus muscle. If it was not removed later these patients usually had recurrent attacks of appendicitis.

I would consequently say in considering patients in the condition of the one before us at the present time that if a safe surgeon is available such patients should invariably be operated at once for the reasons I have given, which will undoubtedly become more apparent as we proceed with the operation. It is for this reason that the family physician requested consultation with a surgeon as soon as he had made his diagnosis, and for the same reason we both agreed upon sending this patient to the hospital the moment we had concluded the consultation. We have lost no time, for while the patient was on the way to the hospital all preparations for the operation were made here so that we could proceed at once.

OPERATION.—The patient is so tender that it will not be possible to prepare the field of operation before he has been anæsthetized. We will consequently proceed with the anæsthesia and will then prepare the field of operation in the usual manner, being extremely careful, however, not to exercise a sufficient amount of force to complete an impending perforation of the appendix.

INCISION.—It seems safe in this instance to make use of McBurney's incision described in connection with the previous case, because this will leave the abdominal wall least impaired after the wound has healed. Had the patient experienced several very severe attacks of appendicitis, it might be reasonable to suppose that much space would be required for the removal of the appendix, which could not readily be obtained through this incision. In case we should find conditions more complicated after opening the abdominal wall than is to be expected from present indications we will still be able to secure an increase in the size of the wound.

It is not likely that we will find an abscess outside the appendix directly underneath the abdominal wall, because this condition is usually accompanied by a condition of œdema of the tissues composing the abdominal wall. Nevertheless, it is wise to be exceedingly cautious in making the incision through the transversalis fascia and peritoneum, in order to avoid injuring the underlying intestines which may be slightly adherent in this case either from the attack the patient experienced a year ago or from the present attack, because frequently these adhesions precede the perforation. This process might have taken place during the slight attack the patient had one week ago.

Upon opening the peritoneum we see a tense, sausage-like object projecting forward between the ileum and the lower end of the cæcum. It is surrounded entirely by a fold of omentum, being adherent apparently only behind to the cæcum and with this to the iliacus muscle. There are no strong adhesions to the omentum, but this structure seems to be loosely agglutinated to the appendix by means of a delicate layer of leucocytes. In stripping away the omentum there is no bleeding and neither the omentum nor the appendix is abraded.

Before attempting to remove the appendix I will lift up the abdominal wall carefully and tampon the space around it with soft pads of aseptic gauze saturated with warm normal salt solution, in order to prevent contamination of the remaining portion of the abdominal cavity in case of rupture of the distended appendix. This leaves the other portions of the abdominal cavity virtually out of the field of operation, which is especially important in a case like the one before us, because we know that the appendix contains septic material and we must guard against its introduction into the abdominal cavity. In this case we will carefully dissect up the appendix from its distal end, going very cautiously and grasping every bleeding point with hæmostatic forceps as we proceed, and applying a fine catgut ligature each time in order to prevent mischief by pulling upon these forceps.

The appendix is extremely tense and half an inch from its distal end there is a greyish, dark, discolored point, a circumscribed gangrene. The mesentery extends to the end of the appendix, but is not free. Evidently the inflammatory disturbance of one year ago resulted in the adhesion, which attached this mesentery to the lower end of the cæcum and to the iliacus muscle. The mesentery is so short that it is not possible to grasp it with hæmostatic forceps or to ligate it before cutting, hence it will be necessary to dissect loose the appendix and to grasp the mesenteric artery when it is divided.

This is ligated directly and now we have the appendix free in the wound projecting from the lower end of the cæcum like a

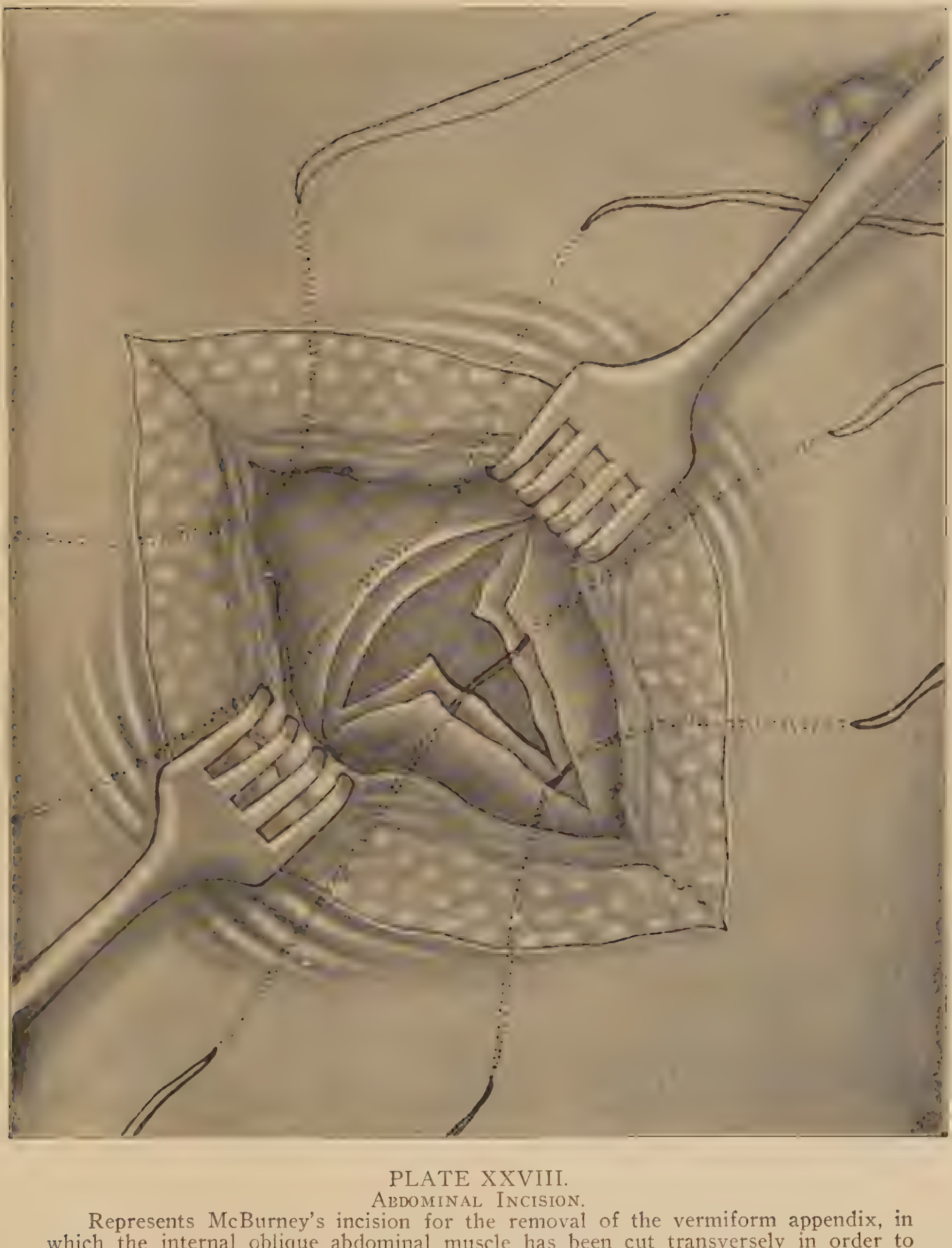


PLATE XXVIII.

Abdominal Incision.

Represents McBurney's incision for the removal of the vermiform appendix, in which the internal oblique abdominal muscle has been cut transversely in order to increase the opening sufficiently to loosen an appendix adherent in the pelvis. This incision across the muscle is not desirable.

sausage, three and one-half inches in length and three-fourths of an inch at its greatest diameter. It is slightly curved upon itself and its walls are œdematous. After surrounding the appendix with warm, moist gauze pads, in order to protect the wound in case of rupture, we apply two pairs of narrow, long-jawed forceps upon the cæcal end of the appendix and cut between these. From this point on the operation proceeds precisely as described in connection with the previous case, with the exception that a little greater care is exercised in applying the sutures in the cæcum, because of the increased vascularity due to the acute congestion. Unless these stitches are applied carefully there is sometimes troublesome oozing from blood vessels, which are at other times too small to be noticed.

An examination of the specimen removed shows that the appendix is completely occluded at its cæcal end on account of cicatricial contraction due to destruction of its mucous lining, which probably occurred during the attack a year ago. The appendix contains pus and mucus and a slight amount of fæcal material in flakes. This seems to indicate that the cæcal end of the lumen was not completely occluded until the beginning of the present attack. The mucous membrane lining the appendix is severely congested and dark and a short distance from the distal end there is an area of about half an inch in diameter which is gangrenous. The œdematous condition of the tissues in the walls of the appendix is very apparent on the surface of the section we have made longitudinally through this organ.

It is quite plain that the removal of this organ must be the proper treatment in cases like the one before us, provided this can be accomplished safely, for the reasons which I have given, but it is equally plain that in such cases it would be an easy matter to infect the general peritoneal cavity, which would of course be a very serious accident.

This case has developed to-day with great severity, and still the conditions we found were favorable for the protection of the general peritoneal cavity against infection, had peristalsis been eliminated by the method described in the previous case. The appendix was surrounded by the omentum which would have disposed of a great amount of infection and would at least have protected the general peritoneal cavity against infection. It is likely, then, that with this treatment even so violent a case as the one under care would in the worst case have resulted in a circumscribed abscess in the right inguinal region. It is for this reason that I believe laparotomy should be performed for the relief of acute appendicitis only when a safe surgeon is at hand and when the other conditions are such as to make a recovery fairly certain.

The conditions in this case and in many other similar ones which I have operated during the first thirty-six hours of an acute attack, show how extremely dangerous it is to encourage peristaltic motion of the small intestines by the giving of food and cathartics by mouth, because in this case such action would probably have been followed by a perforation at the point at which the wall of the appendix was gangrenous and this would have been followed by the rapid distribution of the infectious material to distant parts of the peritoneal cavity. Had the gangrenous portion been toward the cæcum a perforation would probably have taken place into the lumen of the intestine, which would have been favorable for the recovery of the patient.

Had we found it impossible to remove the appendix safely through the incision which was made in the present case the required space could have been obtained by cutting the outer edge of the fascia covering the rectus abdominis muscle, which would have made it possible to slide the inner portion of the edges of the internal oblique muscle apart a considerable distance. If this still fails to give a sufficient amount of space the internal oblique abdominal muscle may be cut at right angles to the direction of its fibers, as shown in Plate XXVIII.

Of course this incision may be lengthened indefinitely, although always done at the risk of weakening the abdominal wall to a great extent, because a muscle once cut at right angles to its fibers can never be restored to an absolutely normal condition, but circumstances may occur which make it necessary to do this in order to secure a sufficient amount of space to make the removal of an extensive adherent appendix possible.

If such a condition is anticipated it is, of course, much wiser to make the incision through the edge of the right rectus abdominis muscle, because this commands the field of operation equally well

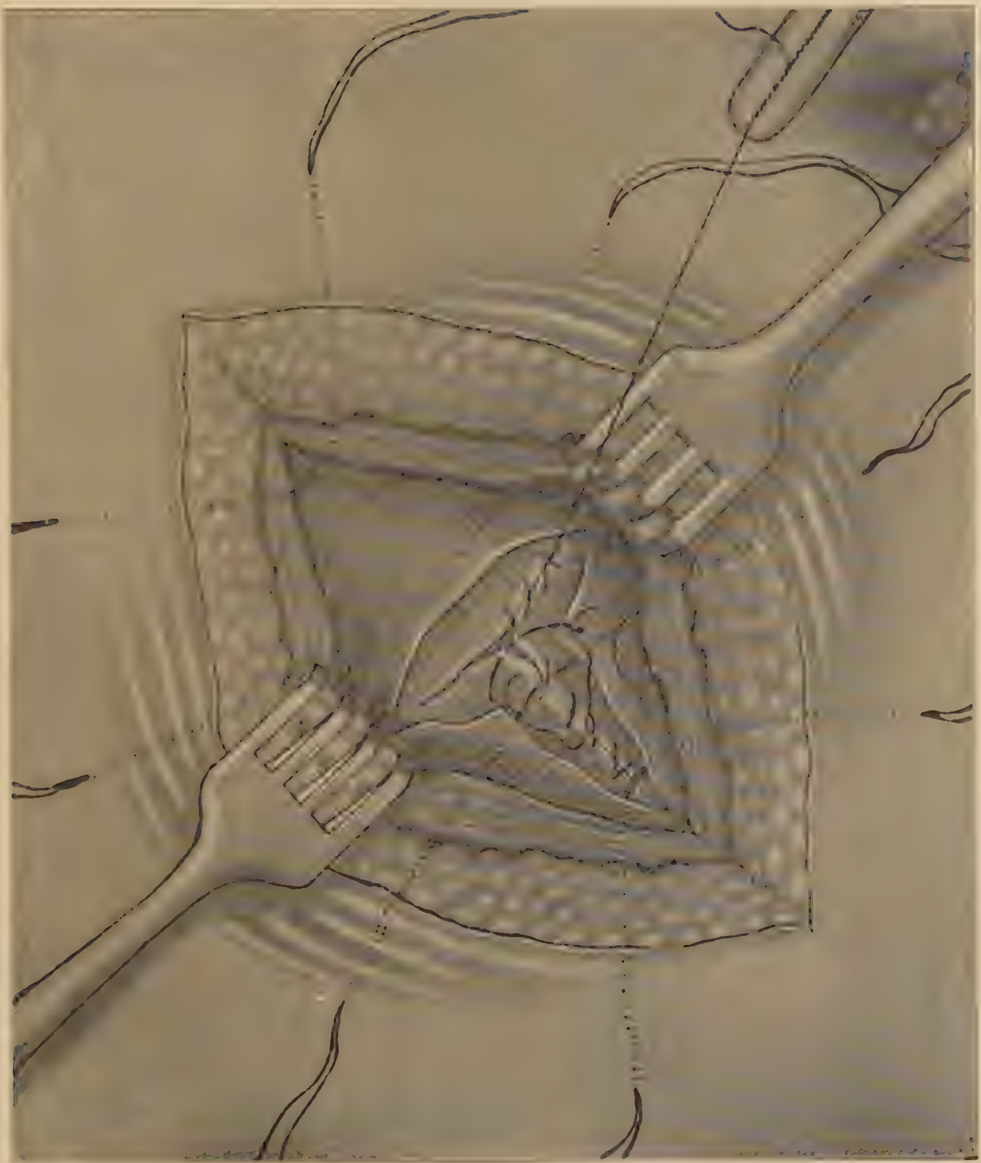


PLATE XXIX.
ABDOMINAL INCISION.

Represents the method of closing the incision shown in Plate XXVIII, the deep silkworm gut sutures grasping all layers down to the transversalis fascia, but being left untied until all of the layers have been united separately by means of cat-gut sutures.

and the incision can be lengthened according to the necessities of the case, but if this has not been anticipated it sometimes, though rarely, becomes necessary to increase the space as indicated in Plate XXVIII. Then the incision may be carried through the lower or the upper, or through both, edges of the muscle, according to the direction in which increased space is desired for the safe removal of the appendix in any given case. If this has been done it is important to secure a closure of the abdominal wound, which will prevent the formation of a ventral hernia.

In order to accomplish such a result I would suggest the following steps: Deep silk-wormgut sutures are first inserted through all layers down to, but not through, the transversalis fascia, as shown in Plate XXIX. These stitches are left untied until the buried sutures have been applied, then they are tied over all, acting simply as stay sutures. The peritoneum and the transversalis fascia are next sutured with continuous catgut, great care being taken to secure as perfect coaptation as possible, because the transversalis fascia gives a valuable support to the abdominal wall at this point and if properly united will aid greatly in preventing the occurrence of a ventral hernia. The transverse incision in the internal oblique muscle is next repaired, making it as nearly normal as possible, as shown in Plate XXX. For this purpose I have used interrupted stitches of fine, chromicized catgut used double. Ordinary catgut might be absorbed before the muscle ends had been thoroughly united and the retraction of the latter, due to muscular contraction, would leave a point of weakness in the abdominal wall.

It is likely that in aseptic cases these muscles will unite very quickly. I have been compelled to enlarge the abdominal wound in this manner in only a few cases and in these the result has been perfectly satisfactory; but I have a great aversion toward any operation which contemplates the cutting of abdominal muscles at right angles and should not advise such an act except in cases in which the McBurney incision seemed to be the best at the time the operation was begun, but proved not sufficiently large to dispose of the conditions found after the abdomen was opened. The further steps in the procedure are the same as described in connection with the previous operation.

ACUTE APPENDICITIS WITH SECONDARY INFECTION OF PELVIC ORGANS IN THE FEMALE.

The patient before us is a school girl, sixteen years of age; has always enjoyed good health, having grown up in the country. She menstruated at thirteen years of age, and has been without pain until one year ago, when she suffered from a typical attack of appendicitis. Since then she has suffered severely during each menstrual period. She has had four typical attacks of appendicitis during the past year; the last one began one month ago and she is just now recovering. Her present condition is that of a very well nourished girl, evidently unusually strong and vigorous when in good health; tongue is clear; appetite good previous to recent attack, now absent; heart, lungs and kidneys normal. A slight swelling is perceptible over the region of the appendix, also slight dullness on percussion; vaginal examination cannot be made as patient is a virgin. She has been nauseated, but has abstained from food almost completely during this attack.

This patient belongs to a class which is not at all uncommon. The characteristic feature lies in the fact that although the first attack was typical of acute appendicitis and the recurrent attacks were similar in character, there is in addition a dysmenorrhœic pain, which is more frequently right-sided. The pain may be so high in the abdomen as to indicate a diagnosis of recurrent appendicitis with each menstrual period, but the fact that it occurs regularly at this time usually results in a diagnosis of dysmenorrhœa and is more commonly attributed to disease of the ovary and tube than to the appendix. The fact that menstruation was painless and normal previous to the primary attack of appendicitis, and that the patient is a virgin, would indicate that the disease must have begun in the appendix. It may still be confined to the appendix and the exacerbation may be due to the congestion incident to the changes present during the menstrual period. The close connection between the right ovary and tube and the appendix, due to the presence of the appendico-ovarian ligament of Clado, would readily explain the effect of this congestion upon a chronic appendicitis. I have repeatedly seen cases where the cæcal end of the appendix was almost

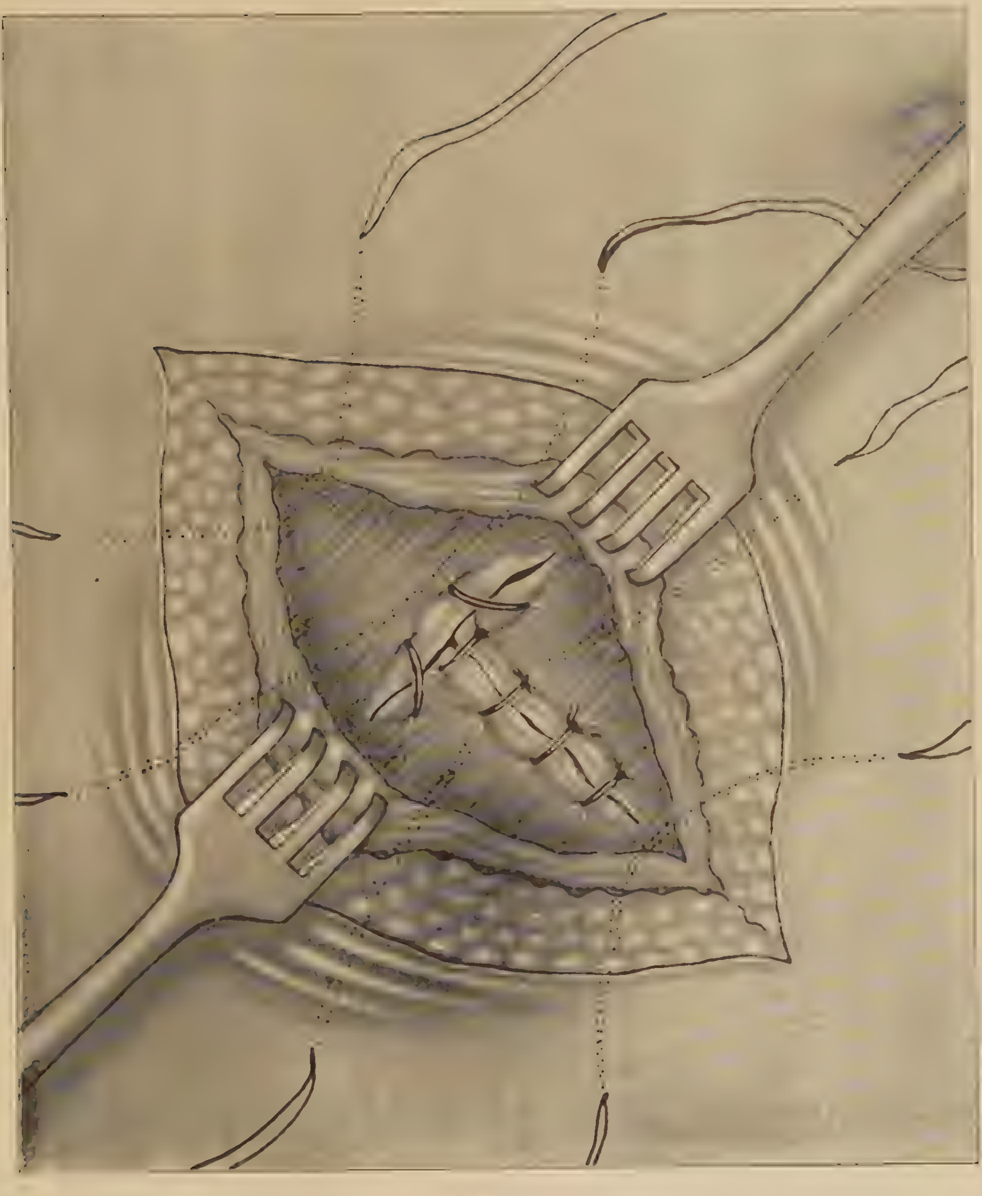


PLATE XXX.

Abdominal Incision.

Represents the method of applying interrupted sutures in order to restore the internal oblique abdominal muscle, in the same case the external oblique being held out of the way by means of retractors.

completely obstructed and the distal end of the appendix contained fæcal concretions or pus or mucus in which the irritation or congestion due to the menstrual period seemed to suffice to cause a complete obstruction temporarily each month, and thus produce a mild attack of appendicitis without resulting in a disease of the ovary and tube.

In other cases in which the primary attack of appendicitis is severe enough to result in an infection extending beyond the vermiform appendix the conditions found are quite different. There may have been a perforation of the appendix and some of the septic material escaping from the immediate vicinity of the appendix into the pelvis may there have been taken up by the fimbriated extremity of the Fallopian tube, through which it may have been carried in the direction of the uterus by means of the ciliated epithelium lining this tube. The infection may have been sufficiently violent in character to destroy a portion of the lining of this tube and thus have resulted in an obstruction, or an adhesion may have been formed between the fimbriated extremity of the Fallopian tube and the ovary, or between any of the other pelvic organs, or directly between the appendix and the Fallopian tube; all or any of these organs may have become adherent to the omentum.

INDICATIONS FOR OPERATION.—The increasing severity of the attack, and the fact that although the patient has recovered from the last attack she still has a perceptible mass in the region of the appendix, would indicate a sufficient amount of pathological change to warrant the removal of the diseased appendix. It seems, however, that the severe dysmenorrhœa which has recurred regularly with each menstrual period since the first attack of appendicitis should be seriously considered.

This condition is undoubtedly due to the secondary involvement of the right ovary and tube. If the patient is not relieved of the cause of this severe suffering, which occurs at such short intervals, she will undoubtedly soon become a neurotic wreck, because she will soon be unable to recover fully from one attack before the beginning of the next one.

It is also likely that many cases of sterility result from the infection of the Fallopian tubes which had its origin in an appendicitis; hence the sooner the latter condition is eliminated the greater the likelihood of averting such a result. This seems of sufficient importance to influence our plan of treatment of acute or recurrent appendicitis in young girls. The possibility of involvement of the pelvic organs with their special complications should demand the removal of the diseased appendix more imperatively than in male children.

In many cases of ovarian cysts I have found the remnants of an appendix, once perforated or partly destroyed by gangrenous appendicitis. It is possible that the cicatricial tissue which formed upon the surface of the ovary because of the peritonitis in this vicinity secondary to the appendicitis may be responsible for the formation of some of these cysts.

The same is true of extra-uterine pregnancy, although in this condition there is more commonly a history of an infection of the Fallopian tubes through the uterine cavity.

Operation.—In this case it seems wise to make the incision through the outer edge of the right rectus abdominis muscle, as indicated in Plates XV and XVI, because we may require a considerable amount of space through which to safely remove an extensively adherent appendix. Moreover, it may be desirable to remove the right ovary and tube if they are sufficiently involved to make their complete recovery to normal unlikely. This incision can be made as short as desirable until the conditions have been determined and then it can be lengthened upward or downward as indicated by the circumstances.

The mass which we were able to palpate through the abdominal wall consists of the omentum surrounding the appendix and the lower end of the cæcum, and adherent to the lower end of this mass we find the right Fallopian tube, which is closed at its fimbriated extremity, and the ovary which is severely congested and twice the size of the left ovary, which is free and normal.

In order to prevent an infection of the surrounding portions of the peritoneum we will tampon these away with a large piece of moist aseptic gauze. It is now one month since the beginning of

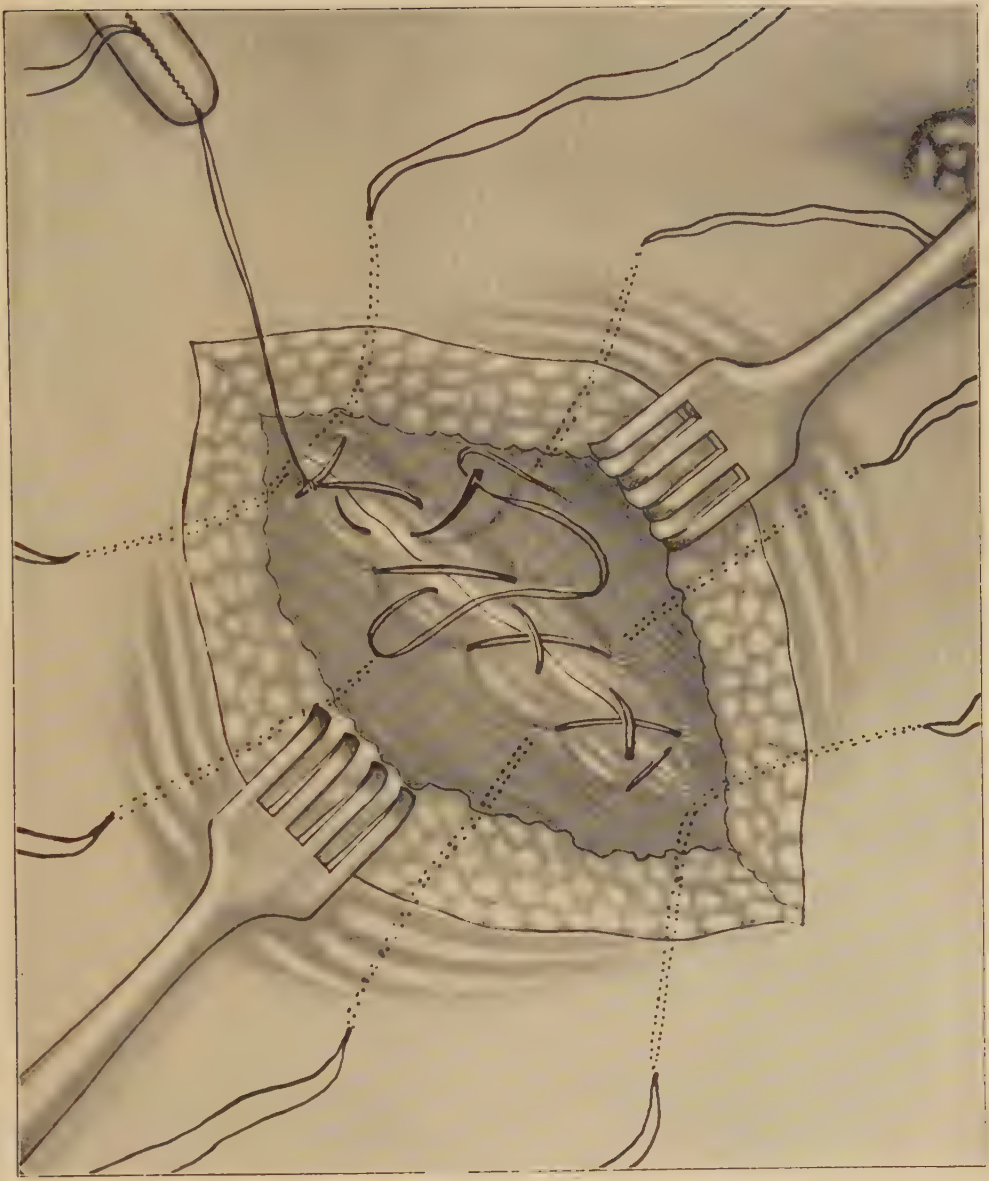


PLATE XXXI.

Closure of McBurney Incision.

By suturing the fascia of the external oblique muscle separately, as indicated in this plate, there is one strong layer which is perfectly restored, which will compensate for a portion of the defect in the internal oblique, as shown in Plate XXX.

The deep silkworm gut sutures are drawn double. It is scarcely necessary to take this additional precaution, but the support from this source is undoubtedly of value until the injury to the internal oblique muscle has had time to become repaired. The deep sutures are tied after all of the layers have been separately united with cat-gut sutures.

the last attack, consequently the pus which may be present is not likely to contain any very virulent micro-organisms. It is, nevertheless, wise to take the same precautions against an infection. I will now proceed to follow the longitudinal band on the anterior surface of the cæcum as the most reliable guide to the location of the appendix, being careful to do as little mischief as possible in loosening the adhesions.

As we loosen the omentum a small quantity of pus is beginning to escape, which we will sponge away with great care before there is any chance of causing an infection. The abscess contains about half an ounce of pus and a fæcal concretion the size and shape of an olive stone, and the perforated appendix which is constricted at the cæcal end and somewhat club-shaped at its distal end. We will ligate the portion of the omentum which helps to form the abscess wall and will treat the appendix as in the previous cases, after carefully separating it from its adhesions to the lower end of the cæcum, to the anterior surface of the iliacus muscle and to the right ovary and Fallopian tube, which have been involved secondarily in this case. When the perforation of the appendix occurred some of the pus evidently escaped into the pelvis and was taken up by the fimbriated extremity of the Fallopian tube which became infected. The fimbriæ became adherent to each other and to the ovary and to the lower end of the adherent mass which I have described.

Occasionally it is better to sever the appendix at its cæcal end and to invert the stump and close the defect in the cæcum as described in the previous operations, and then to enucleate the appendix, because in this manner the cæcum can be pushed out of the way and more room can be gained which will serve to facilitate the enucleation. The same method can sometimes be employed for the removal of an infected Fallopian tube and ovary, the enucleation being begun from the uterine side, the tube being first severed at the uterine end and then enucleated from within outward.

In enucleating the inflamed adherent appendix it is important to bear in mind the fact that the appendicular artery which is found in the remnant of the mesenteriolum of the appendix is a vessel of considerable size, and that a fatal hæmorrhage may occur if this vessel is not thoroughly controlled. The tissues are often so fragile that it is difficult to grasp this artery with hæmostatic forceps without crushing it off and thus increasing the hæmorrhage. If this fact is borne in mind, however, it is possible to grasp this vessel and ligate it safely.

Ordinarily, all of these steps can be carried out safely, if the wound is made sufficiently long to permit the operation to be performed in plain sight; if the other portions of the peritoneal cavity are carefully tamponed away; if the appendix is located without unnecessary manipulations by using the longitudinal band on the anterior surface of the cæcum as a guide and if the entire operation is performed without unnecessary manipulation.

With increasing experience each surgeon learns to recognize his own ability in these manipulations and can determine with a fair degree of certainty how much he can safely undertake to do in any given case.

It would, of course, be much better simply to drain the abscess and later to remove the appendix, than to do the thorough operation, if this seemed safer in any given case, because a second operation for the removal of the appendix could be very safely performed at a future time. This, however, must be left to the judgment of the surgeon who happens to perform the operation, because the point to be determined is not what is the best treatment for such cases in general, but what is the best treatment for the case under consideration with the skill and experience at hand. The general principle, however, is applicable to these cases, as to all cases in surgery, that, other things being equal, the more thorough the operation performed, the better.

Drainage.—Although we have removed this appendix, the infected omentum, the ovary and the tube without contaminating any other portion of the peritoneum, and although we have apparently removed all infectious material, the question whether or not it is wise to drain in this case must still be considered. The fact that an abscess has existed makes drainage permissible. In my own work, I drain much less frequently now than in former years, yet when there is the slightest doubt in any given case I always drain.

Should we drain in this case through any portion of the abdominal wound which extends through the edge of the right rectus abdominis muscle a hernia would very likely result, because the connective tissue formed in the closure of the drainage opening would be very likely to give way. We will consequently make a little incision one inch in length parallel with the fibers of the external oblique abdominal muscle two inches to the right of McBurney's point. This incision is carried through the fibers of the external oblique abdominal muscle down to the internal oblique, the fibers of which extend at right angles to the former. These are also separated and then a small opening is made in the transversalis fascia and peritoneum. Through this opening we carry a glass drainage tube, covered with one or more layers of iodoform gauze, to a point just below the cæcum, from which the abscess was removed. What is left of the omentum is then carried over this surface and then the tampons are removed and the abdominal wall is closed in the usual manner.

After Treatment.—The drainage tube is removed any time between the second and the fifth day, and the gauze one or two days later, when the drainage wound is permitted to heal. Having been made without cutting any muscle fibers, this wound will never cause a hernia, because the edges of the split fibers will be drawn together as a result of muscular contraction, and thus the small opening will be efficiently and permanently closed.

For the first three days the patient will be sustained entirely by means of rectal feeding, nutrient enemata being given every four hours, as described before. If the patient is normal at the end of this time a moderate amount of liquid nourishment will be given by mouth at regular intervals, but if the patient is not normal at the end of this period the exclusive rectal alimentation will be continued. In case of pain morphia can be safely given, preferably by hypodermic injections so long as no food is given by mouth.

In a few cases I have seen both ovaries and tubes, as well as the uterus and bladder, involved secondarily in acute perforative appendicitis. The treatment in these cases must of course contemplate the relief of all of these complications.

In cases in which it is apparent, before the abdomen has been opened, that both ovaries and tubes are secondarily involved, it is usually wise to choose the median incision, because from this the affected parts can all be reached, except in cases in which the appendix is adherent to the posterior surface of the cæcum. However, I have never encountered one of these cases with a secondary involvement of both ovaries and tubes.

In order to emphasize its importance once more I would suggest that in all intra-abdominal operations performed for the relief of dysmenorrhœa, especially if this is more strongly marked on the right side, it is wise to examine the appendix, because very frequently a diseased appendix is the sole cause of dysmenorrhœa.

APPENDICITIS IN CHILDREN.

There are certain features in connection with appendicitis in young children which require especial attention, because if looked upon from the same standpoint as in adults our results will not attain the highest degree of satisfaction.

History.—Frequently a child which has been in most excellent health, whose general appearance indicates no disturbance, whose nutrition is good, and who is in no way suffering, suddenly develops a most violent attack of acute appendicitis. This can be explained in the following manner: The appendix in these children is usually large, but the cæcal end is much the narrowest portion of the lumen. This favors the formation of an enterolith, which eventually either obstructs the cæcal end of the lumen and brings about an acute appendicitis or it causes an ulcer, resulting from pressure necrosis, with the same ultimate result.

In many of these cases the mesentery of the appendix is very short, which still further facilitates the necrosis of the portion projecting beyond the end of the mesentery, because in case of a thrombosis of one of the vessels in this portion there can be no compensatory circulation, while this can readily be established when the mesentery extends to the end of the appendix.

One peculiarity in appendicitis in children is the fact that the attack is almost always looked upon by the parents and friends, and frequently by the physician, as a case of violent, acute gastritis or enteritis, resulting from some indiscretion in eating. This is so common that one rarely sees these young appendicitis patients in whom the correct diagnosis was made from the beginning of the attack.

The omentum in young children is very small and not very substantial, hence it cannot be of as much use in separating the diseased appendix from the general peritoneal cavity as in the adult, and consequently it is necessary, in cases which come too late for an early operation, to watch closely from day to day, and if a circumscribed abscess forms to drain it.

Another difficulty encountered in the treatment of children is their fear of the stomach tube. It is important to employ gastric lavage, but many wilful and badly brought-up children will struggle so violently against its use that even with cocain anæsthesia one may not be able to accomplish the task without danger of injuring the patient because of the struggle required. To a slighter extent the same is sometimes true of rectal feeding.

The most important point, however, is in dispelling the idea that a severe pain in the region of the stomach in children coming on after taking indigestible food is due to gastritis and is consequently of little importance, because so often a careful examination will demonstrate this condition to be a gangrenous or perforated appendicitis. This condition frequently occurs in children not more than four years of age. I have seen a number of cases much younger, one as young as seven months, and the accompanying history of a case observed by Dr. W. B. Helm, of Rockford, Illinois, which I quote because of its unusual interest, shows that it may occur in those still younger.

This patient, a boy three months old, was seen by Dr. Helm, January 5, 1902. He had suffered almost constantly since birth, crying much of the time, night and day. Frequent tenesmus, although bowels were easily regulated. The mother's milk did not agree and various prepared foods were tried. The child took food ravenously, but never seemed satisfied. There was no gain in weight and some fever persisted most of the time. When the child was five weeks of age the local physician was called and detected a right oblique inguinal hernia. There was apparently no trouble in reducing it and he tried various forms of retentive apparatus. Still the crying, straining and fever continued. Seven weeks later the patient began to fail rapidly, and Dr. Helm found it with a temperature of 103° F. and pulse varying from 160 to 190. The child weighed only eight pounds and still cried most of the time. There was a hernial protrusion the size of a small hen's egg. The bulk of the mass could be readily returned, but a small object in the inguinal canal remained. It seemed like an undescended testicle, but both of these organs were found to be in the scrotum. Repeated trials failed to return it to the abdomen, so an operation was advised. On opening the canal the doctor found that the reducible portion was the head of the colon, and the irreducible part was the appendix, slightly adherent and greatly congested. He removed the appendix and closed the canal by the Bassini method. The pain was apparently lessened at once, the fever disappeared on the third day and the child gained two pounds during the first ten days and has since made an uninterrupted recovery.

APPENDICITIS IN OLD PEOPLE.

Fortunately it is but seldom that acute appendicitis occurs in patients very advanced in years. I have seen one case of perforative appendicitis in a woman sixty-eight years of age.

In the treatment of these cases the fact that old people do not well bear confinement to bed in the recumbent position should be borne in mind. These patients should be placed in a semi-sitting posture in order to prevent hypostatic congestion of the lungs. If it seems at all safe, I think it is well to operate these cases at once in order to shorten their confinement as much as possible. But these patients are usually very obese, which still further reduces their chances of recovery. It is consequently necessary in every given case for the surgeon to choose between two evils, and the better his judgment the more likely he will be to choose wisely. If the operation be postponed it is well to reduce the amount of fat

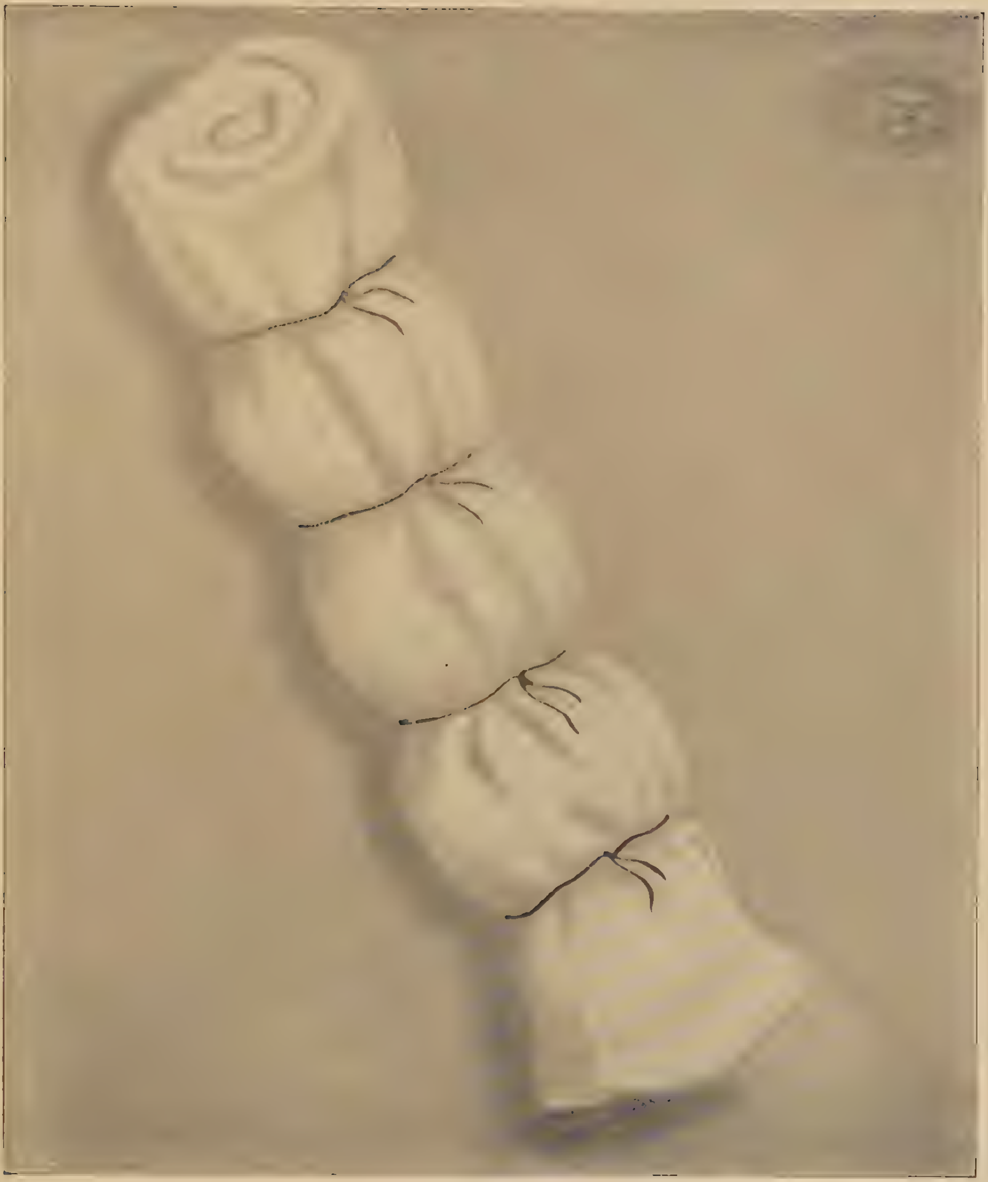


PLATE XXXII.

MEANS FOR PREVENTING SUTURE MARKS.

If it is desired to avoid the occurrence of marks due to the cutting of deep sutures this can be accomplished by placing a roll of gauze directly upon the wound and tying the sutures over this, as indicated in this plate. The same precaution against drawing the sutures too tightly must of course be observed if this method is employed, as in tying the sutures in the usual manner.

The method produces more uniformly perfect results, so far as the absence of an offensive scar is concerned, than the subcuticular suture.

in the abdominal wall of obese patients by proper treatment and to remove the appendix after the patient has recovered from the acute attack.

COMPLICATIONS OF APPENDICITIS.

Any condition which may result from infection, either from direct or metastatic infection, may result as an immediate complication of appendicitis. Of these the most common are circumscribed or diffuse peritonitis with or without the formation of abscess. This complication, as has been stated before, is greatly reduced in its importance if neither food or cathartics are given in these cases from the beginning, because this eliminates the mechanical distribution of infectious material by means of peristalsis. It also prevents the disturbance of septic thrombi, which may be present in the veins at the seat of inflammation, and which might be loosened were food and gas forced through the ileo-cæcal valve; consequently metastatic infection is also greatly reduced in this way. Metastatic abscesses complicating acute appendicitis may occur at any point in the body and must be treated as though they had occurred in connection with the primary infection in any other part of the body.

Many other complications may occur, because the presence of an acute or chronic appendicitis naturally does not preclude the occurrence of any other pathological condition which might be present in a patient not suffering from appendicitis.

Strangulated Hernia.—A considerable number of cases of acute appendicitis complicating strangulated hernia have been reported. I have encountered gangrenous appendices, both in strangulated femoral and inguinal herniæ, and in one case of irreducible umbilical hernia.

I have also operated upon one case of inguinal hernia which was complicated with suppurative epididymitis and orchitis, together with an acute suppurative appendicitis in a case of cryptorchism. In this case the cæcum was so low that by lengthening the herniotomy incision upwards by dilatation it was possible to remove the appendix through this opening. An orchidectomy was performed, the wound was drained and tamponed with iodoform gauze for a week, then it was sutured secondarily. The result was perfect.

Typhoid Fever.—In cities where typhoid fever is endemic it is not a very uncommon occurrence to find difficulty in making a differential diagnosis between typhoid fever and a mild attack of appendicitis, or between the presence of a perforative appendicitis and a perforated typhoid ulcer.

In four instances I have observed patients suffering from plainly marked attacks of acute appendicitis in which a typical attack of typhoid fever followed immediately. In each of these cases the patient had consumed great quantities of infected water during the beginning of his sickness. The fever accompanying the appendicitis caused severe thirst, and the great quantity of water containing typhoid bacilli consumed during the time had brought about the typhoid infection.

I have, of course, seen many cases of simple appendicitis which had been diagnosed typhoid fever, and vice versa, but the cases referred to above did not belong to this class.

Since the introduction of the Widal test it is, of course, much easier in difficult cases to make a positive differential diagnosis, but as the Widal test is applicable only to advanced cases of typhoid fever its value is greatly reduced. In some locations, especially in great cities, in which a large proportion of the population regularly drinks unsterilized water infected with typhoid bacilli, it is wise to bear in mind the fact that typhoid fever and appendicitis may occur at the same time in the same patient.

Of course, the same thing might happen by accident with almost all of the other intra-abdominal conditions. I have personally encountered a renal calculus, an extra-uterine pregnancy, a gastric ulcer, as well as all the varieties of tumors occurring in the uterus and adnexa, in connection with acute appendicitis. It is likely that in each case the fact was due simply to a coincidence and that no casual relation existed between the two conditions.

Floating Kidney.—The presence of an abnormal mobility of the right kidney, either with or without general enteroptosis, is not at all uncommonly found in connection with chronic recurrent appendicitis. It is possible that the increased intra-abdominal pressure which has to be employed to overcome the obstruction to the passage of gas and fæces through the ileo-cæcal valve in these cases may be responsible for the mobility of the kidney, or it may simply be a coincidence.

In many of these cases there are extensive adhesions which interfere seriously with the fæcal circulation, causing the intestines and the stomach to be constantly distended with gas, and this may help to account for the mobility of the kidney.

Thrombo-Phlebitis.—Occasionally in cases of appendicitis which have not been operated, and more frequently following operation, there is a thrombo-phlebitis of the external iliac vein. Ordinarily the condition does not materially interfere with the recovery. The same precautions should, however, be employed as in a thrombo-phlebitis from any other cause. If a small portion of the thrombus is displaced, it is likely to cause serious trouble and may even give rise to thrombosis of the pulmonary artery, causing sudden death.

Surgery of the Gall Bladder.

GENERAL CONSIDERATIONS.

In order to comprehend fully the conditions one finds in the treatment of diseases connected with the gall bladder, it is important to bear in mind its anatomical relations as well as its mechanical provisions. So long as its anatomical relations are normal, and the organ is, mechanically considered, approximately perfect, there is no occasion for treatment because the gall bladder becomes distended with bile, which is a non-irritating fluid and empties itself regularly. These functions give rise to neither pain, irritation or discomfort.

Normally, the gall bladder is suspended from the lower surface of the liver as a very slightly distended, pyriform sac, which empties its fluid rapidly into the duodenum. The muscles of the gall bladder are very active and well able to empty the contents.

It seems to have been proven beyond a doubt that this pouch shares the fate of all similarly constructed organs in the body—the stomach, the urinary bladder, the pelvis of the kidney, the vermiform appendix; so long as there is nothing to prevent these organs from emptying their contents they are almost certain to remain normal, but so soon as an obstruction occurs, interfering with the natural emptying of the organ, trouble is likely to ensue. In other words, an interference with drainage is sure to cause a certain amount of residual substance which makes the accumulation of bacteria possible, and from this accumulation we must expect injury to the lining of the organ. The injury may simply be catarrhal at first, but will later become destructive to the mucous membrane, giving rise to ulceration; this in turn will result in cicatricial contraction, and this in further obstruction. In this manner the condition must progress from bad to worse.

In the meantime the mucus and debris in the gall bladder may have been molded into gall stones by the contraction of the gall bladder and thus give rise to another important element. The lining of the gall bladder is now no longer in contact only with the relatively non-irritating bile, but also with these hard bodies, which are often of very irregular form, frequently having sharp angles or projections.

Clinical experience has convinced me that the above theory is correct, because in most of my cases there has been a distinct interference with the natural drainage of the gall bladder. In many cases this was caused by a drawing down of the viscus by adhesions to the omentum or transverse colon, or both; probably caused by a peritonitis resulting from a perforative appendicitis which the patient had sustained many years before. In other cases there was a pedunculated gall bladder, which has been attributed to the effects of tight lacing, and as in many cases this condition occurred only in women, it seems possible that this view is correct.

It has been found that bacteria, especially the colon bacillus, are present with great regularity in diseased gall bladders and in gall stones. It has been found that a large proportion of gall stone patients previously suffered from typhoid fever, and I have found that more than thirty-five per cent. of my cases suffered from acute or chronic appendicitis. It is difficult to determine whether typhoid fever, disease of the gall bladder, and of the appendix in appendicitis, is simply a simultaneous infection or whether the infection of the gall bladder is secondary to the other infections.

In experiments upon animals it has been shown that the simple infection of the gall bladder gives rise to no pathological condition, provided there is no obstruction to the biliary or cystic duct. The constant flow of new bile seems to be sufficient to dilute and wash away the infectious material to a sufficient extent to make the infection harmless.

It is quite different as soon as there is an obstruction to the ducts. When there is residual bile in which the micro-organisms can multiply, a pathological condition will ensue which may simply develop into a catarrhal inflammation of the mucous lining of the gall bladder, or it may result in the formation of gall stones, or in a severe inflammation of the gall bladder involving the anatomical structures beyond the mucous membrane.

In man this obstruction may result from the inflammation of the mucous membrane of the common duct due to an infection from the alimentary canal; or, as I have seen in a number of cases, the gall bladder may be drawn downward by adhesions, causing a short bend in the common, or more usually in the cystic, duct; or an adhesion between the stomach and duodenum and the liver or the gall bladder may have the same effect. This condition is often due to a gastric ulcer. Again the gall bladder may be forced down out of its normal position on account of tight lacing and the mucus and debris, accumulated in this pouch containing residual bile, may be expelled at intervals and may clog the biliary or the common duct, and thus form the obstruction necessary to make the infectious material effective. I have repeatedly observed a complete obstruction of the common duct produced in this manner. Moreover, I have observed some of the most violent paroxysms of gall stone colic in cases of this kind.

If this obstruction persists in the presence of infectious material in the gall bladder a suppurative inflammation may ensue and this may result in an empyema of the gall bladder; if the infection is severe, especially if there be present spasmodic contraction of the gall bladder, the entire mucous lining of the latter may become gangrenous, a condition which I have repeatedly observed in acute cases. This may in turn extend to the other layers of the gall bladder, resulting in a gangrene of the entire organ, or this condition may affect only a small portion of the gall bladder. When this is the case, the contraction of the non-affected portion of the gall bladder is likely to cause a perforation at the gangrenous point.

It is of practical interest to know that these spasmodic contractions of the gall bladder correspond with the contractions of the stomach and that they will subside when the stomach is at rest, only to recur when this condition of rest in the stomach is interrupted.

I have repeatedly observed that attacks of gall stone colic which would not subside from the use of as much as one-half to three-fourths of a grain of morphine given hypodermically, would stop directly upon irrigating the stomach with very hot water and thus putting the stomach at rest, only to recur the moment any form of food was taken into the stomach giving rise to the normal contraction of this organ. In these cases a renewed use of gastric lavage and further abstaining from food would result in permanent interruption of the spasmodic contraction of the gall bladder. This point is of great practical importance, because it does not only indicate an efficient means for securing the relief of pain, but also for preventing further destruction of gall bladder tissue and possible perforation. In case perforation should still occur it would be much more likely to take place into the alimentary canal if the stomach and bowels have been at rest.

I have seen one case in which the gall bladder was adherent to the anterior abdominal wall an inch below the umbilicus. There was a perforation of the abdominal wall at this point half an inch in diameter, communicating with a hernial cavity underneath the deep fascia one and one-half inches in diameter which contained seven gall stones and a quantity of pus and granulation tissue. I have seen two other similar cases and one gall bladder which had perforated into the stomach, and others which had perforated into other portions of the alimentary canal have been described by different observers.

I have found a gall stone in the ileum one and one-half inches in diameter, which must, of course, have entered this viscus by ulceration, as it was too large to pass through the cystic or the common duct. The operation was performed for the relief of acute intestinal obstruction and the patient's condition was too serious to permit the necessary manipulations to locate the point of perforation, hence this could not be determined.

I have had all the cases tabulated in which I operated for disease of the gall bladder during the year 1901 at the Augustana Hospital; forty-eight in all.* A study of this table shows a number of facts which are worth bearing in mind. The points to which I wish to direct attention especially refer, 1, To the sex of the patients, there being nearly four times as many women as men in this table; 2, To the age, only one of the patients being less than thirty years of age at the time of admission, although a large number of these patients refer the beginning of their symptoms back to the period of life between twenty and thirty years; 3, I have noticed that a large proportion, nearly eighty per cent., of these patients complained especially of digestive disturbances and that almost all of them had been treated by a number of physicians for gastritis; 4, More than one-half the number of these patients have never suffered from distinct biliary colic; 5, Only a small proportion of these cases have been severely jaundiced at any time, and in more than one-half of the number no jaundice had ever been observed; hence the two symptoms upon which so much stress has always been laid in the diagnosis of gall stones have been absent in by far the greater number of these cases. The third classical sign, the passage of gall stones in the fæces, was absent in all but a few of these cases. I believe consequently that it will be necessary to change the basis of our diagnosis entirely, because the old plan must continue to result in wrong conclusions.

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*See table appended to this chapter.

The symptoms which will most constantly lead to a correct diagnosis when gall stones are present are not biliary colic, jaundice and passing of gall stones with the fæces, as we have been taught for many years; but,

1. Digestive disturbances, a feeling of weight or burning in the vicinity of the stomach after eating; gaseous distention of abdomen.

2. A dull pain extending to the right from the epigastric region around the right side about at a level with the tenth rib, passing to a point near the spine and progressing upwards under the right shoulder blade.

3. A point of tenderness upon pressure between the ninth costal cartilage on the right side and the umbilicus.

4. A history of having had one or more attacks of appendicitis or typhoid fever.

5. In many of these cases there is a slight tinge of yellow in the skin, not sufficient to be recognized as icterus, but still sufficient to be perceptible upon close inspection, especially on the days on which the patient is not feeling very well, when she complains of feeling "bilious."

6. There is usually an increase in the area of liver dullness.

7. There may be a swelling of variable size opposite the end of the ninth rib.

Of course, if we have added to these symptoms the biliary colic, followed by distinct jaundice and possibly by the passage of biliary calculi our diagnosis is still further confirmed, but even without these last three conditions we must make the diagnosis ordinarily or we will miss it in most patients suffering from gall stones.

So long as the gall stones simply remain in the gall bladder without causing any complications the harm to the patient is relatively slight. His comfort will be greatly disturbed on account of the disturbances in his digestion. The pain will not be extreme and he usually accumulates an abundance of fat, especially in the abdominal walls. It has consequently been held by many authorities that it is not wise to make use of radical measures for the removal of gall stones so long as they do not give rise to any grave disturbances. This would undoubtedly be a proper and reasonable view to take were the danger to the patient approximately the same before and after the occurrence of these complications.

This, however, is not the case, as is shown in this series; all of the cases which were operated before any serious complications occurred, recovered, while the deaths happened in cases which could undoubtedly have been saved had they been operated earlier.

The complications which are likely to be caused by the presence of gall stones may be chronic in character, taking the form of digestive disturbances and giving rise to almost constant discomfort. This condition is probably due to the interference with the passage of food through the pylorus into the duodenum, causing dilatation of the stomach.

Again, the patient may constantly be in a slightly septic condition, because there is more or less absorption of septic material from the infected residual bile as well as from the products of fermentation in the dilated stomach. These conditions frequently result in chronic invalidism, making it impossible for the patient to follow ordinary occupations and to enjoy life in any way. The constant irritation of the gall bladder, due to the pressure of the gall stones, undoubtedly has much to do with the development of carcinoma in this organ.

In cases of primary carcinoma of the gall bladder I have always been able to get a history of gall stones dating back many years, and I have invariably found these present in the gall bladder in such instances at the time of the operation or autopsy. Aside from these chronic conditions, gall stones may at any time cause exceedingly grave acute conditions. These complications are all the result of inflammation and the sequelæ must consequently depend upon the extent to which this develops.

I take the following list of complications from Mayo-Robson's excellent work on this subject, because its arrangement is most satisfactory:

1. Ileus due to atony of the bowel, leading to enormous distention, and to the symptoms and appearances of acute intestinal obstruction, apparently the consequence of the violent pain.

2. Acute intestinal obstruction dependent on:
   - (a) Paralysis of gut, due to local peritonitis in the neighborhood of the gall bladder.
   - (b) Volvulus of small intestine.
   - (c) Stricture of intestine by adventitious bands originally produced as a result of gall stones.
   - (d) Impaction of a large gall stone in some part of the intestine after ulcerating its way from the bile channels into the bowel.

3. General hæmorrhages, the result of long-continued jaundice, dependent either on gall stones alone or on cholelithiasis associated with malignant disease.

4. Localized peritonitis, producing adhesions, which may then become a source of pain even after the gall stones have been removed.

5. Dilatation of the stomach, dependent on adhesions around the pylorus.

6. Ulceration of the bile passages, establishing a fistula between them and the intestine.

7. Stricture of the cystic or common duct.

8. Abscess of the liver.

9. Localized peritoneal abscess.

10. Abscess in the abdominal wall.

11. Fistula at the umbilicus, or elsewhere on the surface of the abdomen, discharging mucus, muco-pus, or bile.

12. Empyema of the gall bladder.

13. Infective and suppurative cholangitis.

14. Septicæmia or pyæmia.

15. Phlegmonous cholecystitis.

16. Gangrene of the gall bladder.

17. Perforative peritonitis, due to ulceration through, or to rupture of, the gall bladder or the ducts.

18. Extravasation of bile into the general peritoneal cavity.

19. Pyelitis on the right side, due to a gall stone ulcerating its way into, or an abscess of the gall bladder bursting into, the pelvis of the kidney.

20. Cancer of the gall bladder or of the ducts.

21. Subphrenic abscess.

22. Empyema of the right pleura.

23. Pneumonia of the lower lobe of the right lung.

24. Chronic invalidism and inability to perform any of the ordinary business or social duties of life.

25. Suppurative pancreatitis.

26. Chronic interstitial pancreatitis.

27. Infective endocarditis.

28. Cirrhosis of liver.

TREATMENT.—In any case complicated with an acute inflammatory condition, I believe the same general principles should be employed in the treatment of this condition as in inflammatory processes involving the peritoneum from any other cause. So long as there is no circumscribed accumulation of pus the treatment must consist in rest. This can be secured most readily by using gastric lavage in order to remove remnants of food or decomposing mucus from the stomach, then prohibiting the use of food and cathartics by mouth.

The use of moist heat in the form of poultices or fomentations, or of cold by means of an ice bag, gives the patient great comfort and is undoubtedly beneficial. Morphia may be given hypodermically if necessary, but so long as neither food nor cathartics are given by mouth the pain usually subsides rapidly and permanently. Nourishment may be given by enema not oftener than once in four hours, nor in larger quantities than four ounces at a time. I prefer for this purpose one ounce of any one of the various reliable predigested foods mixed with three ounces of warm normal salt solution. Unless the acute condition is complicated with a mechanical obstruction of the intestines, the patient's chances for recovery from the acute attack are always better without than with an operation.

It is necessary to make a definite distinction between intestinal obstruction due to peritonitis and the same condition due to a mechanical condition, such as the impaction of a gall stone. The former condition is so much more common than the latter that it is only very seldom that the latter need to be considered. Mechanical obstruction due to the impaction of a gall stone is characterized, in the early part of the attack, by the fact that the condition is evidently not due to an inflammatory cause.

When the patient has recovered from his acute attack the further treatment may be conducted medically, which will not cure him but may improve his condition very greatly, or surgically, which is likely to result in a perfect and permanent recovery.

The medical treatment must consist chiefly in the use of large quantities of water, preferably taken hot, and in the use of a diet fairly free from sugar and starch.

I believe, however, that the greatest benefit comes from drinking a great amount of good water and never eating quite enough to satisfy the hunger, and from taking vigorous out-of-door exercise, such as horseback riding, walking or rowing. Sodium phosphate in doses of one drachm or more, taken in a large goblet of hot water half an hour before each meal, and pure olive oil taken in doses of one-half to four ounces at bed time in the foam of beer, ale or malt extract, or in orange wine, seem to have given relief to patients suffering from gall stones, many of them remaining free from severe attacks for long periods of time by taking these remedies with diet and proper exercise.

Whether the relief is due to the fact that in this manner constipation is prevented, and elimination facilitated by the use of large draughts of hot water, or whether there is some special virtue in the remedies, it is difficult to say. That many patients are relieved of their gall stone colics upon following this plan of treatment there can be no doubt. It is plain, however, that this form of treatment can be of benefit only to a limited number of patients, namely, those in which there is no impaction of the gall stones in the gall bladder or in the common or cystic duct and which are not complicated with serious lesions of any portion of the mucous membrane lining these parts, or with extensive adhesions.

Moreover, there are but few patients who are willing to follow any strict form of treatment long after they are apparently well, and consequently they are likely to have recurrences with one or more of the complications which have been enumerated. Aside from this there is always the danger of the occurrence of carcinoma as a result of the long continued irritation.

For all cases, then, which cannot be relieved in this manner with any degree of permanency, and for those who are unwilling to undergo continuous medical and hygienic treatment for the sake of securing relief from paroxysms without being relieved of their gall stones, nothing remains but the removal of the gall stones by an operation.

OPERATION.—In this, as in every intra-abdominal operation, it is wise to limit the manipulations as nearly as possible to the immediate vicinity of the part operated upon, namely, the gall bladder and ducts, because the shock can in this manner be reduced to the smallest possible amount.

INCISION.—The incision should be made through the outer edge of the right rectus abdominis muscle about one and one-half to three inches in length, beginning one inch below the costal arch. If there are no adhesions, and the gall bladder is distended with bile, it will present in this incision as soon as the peritoneum has been opened; otherwise it may be hidden underneath the edge of the liver or in a mass of adhesions.

EXPLORATION.—It is best always to explore the gall bladder, the cystic duct and the common duct by inserting the right hand into the foramen of Winslow and grasping these structures successively between the thumb above and the fingers below. If no gall stones are found in the common duct it is usually not necessary to enlarge the incision unless the gall bladder is greatly shrunken; but if there are stones in the common duct it is best to make a free incision at once in order to be able to perform every step of the operation in plain view. Before going further with the operation, it is well to bring up the cæcum and inspect the appendix. So large a proportion of gall stone cases are complicated with chronic or recurrent appendicitis that it is best not to overlook this organ. If the appendix is not normal it is removed in the ordinary way.

Then the entire cavity is carefully tamponed away with aseptic gauze moistened in warm, sterile, normal salt solution. This step is of great practical importance, because no one can ever be certain that the contents of the gall bladder or duct is sterile. If the gall bladder is distended with bile it is well to insert a large cannula and to aspirate this fluid before opening the organ. It is well to lift up the edges of the gall bladder as soon as it is opened by means of hæmostatic forceps, in order to prevent the spilling of any remnants of bile which may still remain and can be removed by packing long strips of moist gauze into the gall bladder and withdrawing them. If there are gall stones in the gall bladder these can usually be removed most conveniently with a blunt curette. If there are also gall stones in the cystic duct these can frequently be forced back into the gall bladder by gentle pressure from without. Occasionally it is well to dilate this duct slightly by means of a pair of forceps or a uterine dilator. In some cases it is possible even to push back the gall stones from the common duct into the gall

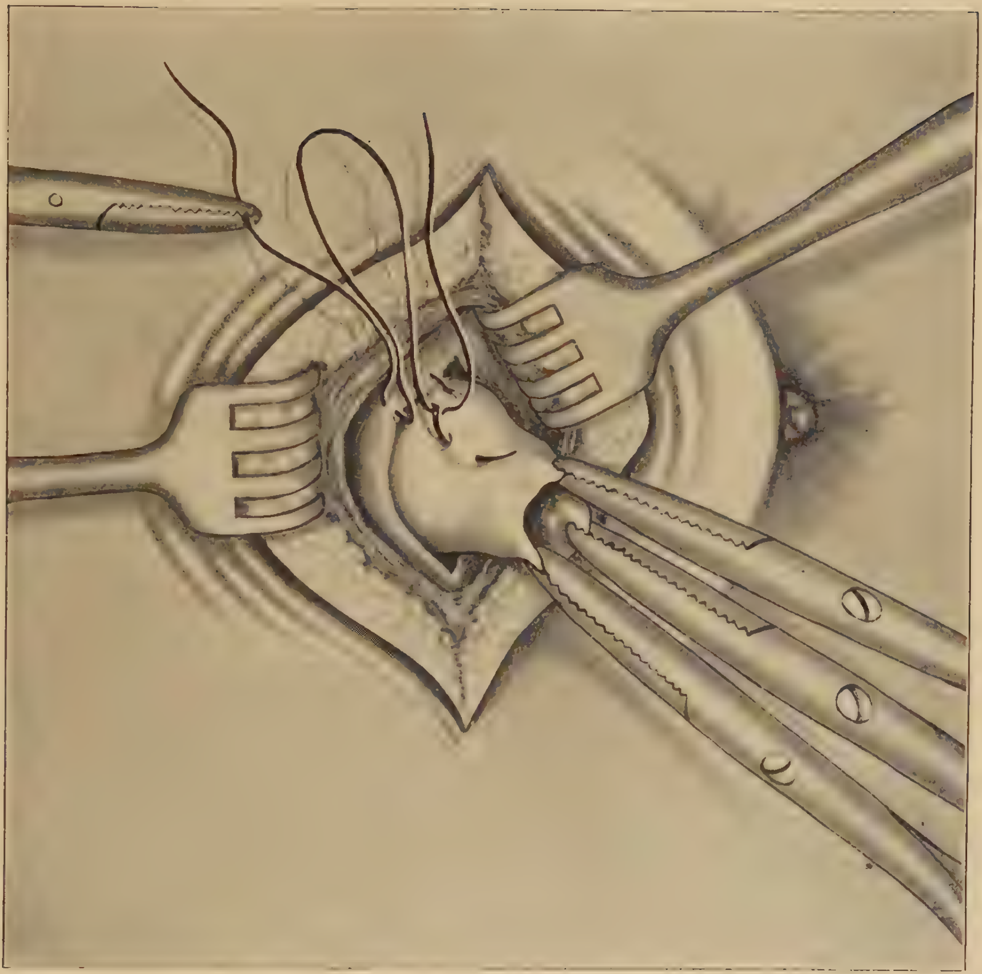


PLATE XXXIII.

CHOLECYSTOTOMY.

The wound is held open by means of sharp retractors. The gall bladder is drawn out of the abdominal wound by means of hæmostatic forceps; one suture is in place attaching the gall bladder to the peritoneum and transversalis fascia, and a second suture is being applied. The umbilicus should be opposite the lower end of the incision, instead of being opposite its center.

bladder in the same manner, but this is not usual. If this cannot be done it is best to place one finger underneath the duct and then push the stone forward and make a longitudinal incision over the most prominent part of this object, which will be forced out through the opening as soon as it is large enough.

It is best to insert a rubber tube directly into the opening in the duct and to prevent it from slipping by stitching it to the duct above and below with a catgut suture. Then a strand of iodoform gauze is stitched to the duct above and below the incision and a glass drainage tube covered with one or two layers of iodoform gauze is inserted into the pouch underneath the liver in order to drain this space, which is so likely to be infected. In case this provision does not seem efficient, it is often wise to puncture the abdominal wall just above the right kidney and to pass a drainage tube into the pouch underneath the liver through this opening.

The gauze tampons, which were employed to pack away the general peritoneal cavity before opening the biliary tract, are not disturbed until the operation upon the biliary tract has been entirely completed, in order to avoid infection.

In case the gall stones are confined to the gall bladder the latter is carefully surrounded by moist aseptic gauze pads, then if the gall bladder is distended with fluid this is first aspirated through a trocar about one mm. in diameter. The fluid may consist of normal bile, or a pure transparent liquid or thick brown or black viscid fluid mixed with a sand-like substance, or it may be like thick tar, or it may consist of pus. After this has been withdrawn as carefully as possible, the trocar is removed and the opening is enlarged. The gall stones are then removed, preferably by means of a blunt curette. After palpating the inside of the gall bladder, in order to make sure that all the gall stones have been removed, it is tamponed loosely with iodoform gauze and then it is drawn out of the abdominal wound, as shown in Plate XXXIII and a row of interrupted catgut sutures are applied to attach it to the parietal peritoneum and transversalis fascia. It is well to insert the stitches down to, but not through, the mucous membrane of the gall bladder. It is also well to remain one-half or three-fourths of an inch back from the edge of the wound in the gall bladder. This will not only serve to prevent infection, but will facilitate the healing of the wound in the gall bladder after the drainage has been removed by the infolding of the edge of the gall bladder.

In many cases in which the gall bladder has been exposed to the irritation due to the presence of gall stones, together with the repeated inflammatory disturbances for a considerable period of time, its walls become contracted and thickened, and it is not possible to attach them to the peritoneum and transversalis fascia. In these cases drainage may be secured by suturing a rubber drainage tube into the remnant of the gall bladder, after the fashion described in connection with the drainage of the common duct after the removal of a gall stone from this point. If this does not seem indicated from the condition present it may be well to carefully dissect out the gall bladder, being careful to guard against hæmorrhage, because some of the small vessels in the gall bladder bleed very freely.

A still better method consists in the removal of the mucous lining of the gall bladder, as described by Mayo. This method consists in beginning about the middle of the gall bladder and dissecting out the mucous lining until the cystic duct is reached. This is ligated with a cat-gut ligature, the gall bladder is then cut away, a gauze strand is brought down to the stump and permitted to project from the angle of the wound. It is well to attach the gauze to the stump of the gall bladder in order to prevent its displacement when the patient vomits.

One frequently encounters very obese patients suffering from gall stones. In these cases it is well to make a much longer incision through the fat down to the aponeurosis of the external oblique abdominal muscle than is necessary to make through this aponeurosis, because in this manner one can secure a great amount of space without increasing the likelihood of the formation of post-operative ventral hernia.

In cases in which there is no direct indication for an immediate operation, it is well to systematically reduce the weight of the patient by the method which has been described heretofore.

It is usually well to have the patient lie a little more to the right side for a few days following the operation to facilitate drainage.

After-Treatment.—No food is given by mouth for several days, in fact, until the patient is normal. The drainage tubes are removed about the fourth day. If there is no pain the iodoform gauze tampon is left in the gall bladder for the same period of time; if there is pain it is removed sooner.

If the lining of the gall bladder has been severely inflamed, a drainage tube is inserted and kept in place for several days or weeks, in order to secure free drainage. If it is not severely inflamed it is permitted to heal spontaneously as soon as the gauze has been removed.

Contra-Indications to Operation.—In disease of the gall bladder there are some definite contra-indications to operation which, I believe, have now been quite thoroughly established by clinical observation.

1. It is ordinarily unwise to operate during the attack of gall stone colic.

2. Severe icterus is a contra-indication to a prolonged operation.

3. The same is true of prostration following long continued suffering.

4. Cases complicated with carcinoma belong to the same class.

5. Patients with ecchymotic spots are almost certain to die if operated.

In all of these cases, if an operation must be performed, it should be limited to drainage of the gall bladder and removal of the stones in this viscus, and all further manipulations should be postponed until the patient is in a better general condition.

It is safe to permit these patients to sit up very soon after the operation, and this frequently prevents the occurrence of hypostatic congestion of the lungs, to which these patients are especially liable.

Haemorrhage Following Operation.—Severely jaundiced patients are especially liable to hæmorrhage following operation.

This is true especially of cases in which there exists at the time of operation ecchymotic spots in various portions of the body, giving the impression of surfaces which have been severely bruised. In these cases it is especially important to ligate the cystic artery, which is otherwise not worthy of especial attention, because in these cases a fatal hæmorrhage may come from this vessel.

In some instances, tamponing the gall bladder with strands of gauze saturated with a solution of suprarenal extract, has resulted in a cessation of the hæmorrhage. Chloride of calcium, chemically pure, in doses of one drachm given in a pint of water three times a day for one or two days, seems also to be valuable, as it increases the coagulability of the blood. This may be given in the form of an enema if the patient objects to taking it by mouth on account of its disagreeable taste.

Biliary Fistulae.—In a certain proportion of cases of cholecystotomy the fistula formed by uniting the gall bladder with the edges of the abdominal wound refuses to close. In some of these cases bile is expelled from this fistula, which indicates that there is an obstruction in the common duct. This is plainly the case, because the obstruction must be at some point betwen the hepatic duct and the duodenum. Were this not so, the cicatricial contraction of the tissues surrounding the sinus would close the latter very rapidly.

This condition may be due to an inflammatory state of the duct in which the congested, infiltrated, œdematous walls occlude the lumen of the duct, or to the presence of a gall stone in the common duct, or it may be due to the late results of inflammatory disturbance in the form of a cicatricial stricture of the common duct.

In case it is due to an inflammatory condition, the drainage of the gall bladder will secure rest for the inflamed tissues of the duct and this will result in the disappearance of the inflammation. It may require several weeks for this to occur, or it may occur within a short time. As soon as the inflammation has subsided and the free flow of bile through the common duct has been established, the fistula will show a tendency to close. One should not be discouraged if this does not follow very soon after the operation, because there may be much infiltration of the tissues of the duct which can not be absorbed rapidly, but which is certain to occur if no ulcer has as yet developed, the contraction of which might result in a permanent stricture. In this class of cases a spontaneous recovery may consequently be expected.

If the obstruction is due to the impaction of a gall stone in the common duct, it may be relieved by the spontaneous passage of the stone, which frequently occurs after the accompanying obstruction due to an inflammatory condition of the common duct has subsided as a result of the drainage of the gall bladder. Occasionally this can be facilitated by injecting olive oil, liquid vaseline, glycerine or warm water into the gall bladder through the sinus, and thus forcing the stone into the duodenum. This should not be attempted until the gall bladder has been drained for several weeks. In some cases the obstruction has disappeared shortly after administering pure olive oil in doses of four ounces or more, given once a day, preferably at bed-time. It is difficult to say whether the oil is responsible for these results or whether it is simply a coincidence.

If all of these means do not result in relief, it becomes necessary to resort to a second operation. In this the incision should be made between the original wound and the median line, because this will more thoroughly expose the diseased part. It is important to have the incision sufficiently long to thoroughly expose the field of operation, because this adds greatly to the safety of the procedure.

If a stone is found in the common duct the remaining portion of the peritoneal cavity should be carefully tamponed away. The duct is pressed forward at the point occupied by the stone by placing one or two fingers behind it in the foramen of Winslow. A longitudinal incision is made sufficiently long to permit the stone to pass through without the use of force. A rubber drainage tube is placed in the opening in the duct and passed out through an angle of the wound. It is held in position in the duct by a fine cat-gut stitch above and below. Two further stitches will hold in place two strands of iodoform gauze, which are passed out through the angle of the wound on either side of the drainage tube. This will protect the peritoneal cavity and serve as a drain for the escape of bile.

The cat-gut will be absorbed after four to seven days, when the drainage tube may be removed; the wound in the duct will now close rapidly. The strands of gauze may remain in place for a few days after the tube is removed, when they may be withdrawn.

If it is found that the obstruction is due to a stricture resulting from the cicatricial contraction in a healing ulcer it is usually best to make an anastomosis between the gall bladder and the transverse colon. This is far easier than an anastomosis with the duodenum, and consequently safer, judging from the permanent results in cases in which it has been done. This operation can be accomplished most conveniently by loosening the gall bladder from its attachment to the abdominal wall, cutting away the cicatricial tissue which has formed at the opening, inserting a Murphy button into this opening and attaching it to the colon by means of this button, being careful to choose a portion of the colon so as to avoid all tension.

There is, however, a much more common cause for the persistence of a biliary fistula after cholecystotomy. This occurs in cases in which there is an obstruction of the cystic duct. In these cases there has usually been an impaction of a gall stone in the cystic duct resulting in an ulcer, which, upon healing, has occluded the duct. In these cases the fistula does not discharge bile, but mucus, which is secreted by the lining of the gall bladder. Usually the discharge is not constant, but the fistula closes until the gall bladder becomes distended with this mucus, when pain will occur and the fistula will open and discharge, only to close again when the gall bladder has emptied its contents. In these cases the patients suffer severely whenever the fistula has closed and the gall bladder becomes severely distended. The mucus usually contains micro-organisms, consequently there is a certain amount of septic absorption whenever the fistula is closed.

In these cases it is best to make a secondary operation, consisting in the removal of the mucous membrane lining the gall bladder down to the cystic duct. This can be done most conveniently by making an incision around the fistula, loosening the attachment of the gall bladder, and about the middle of the organ cutting through all the coats down to the mucous membrane, which can usually be enucleated with comparative ease from this point down to the cystic duct. At this point the sac is grasped with a strong pair of hæmostatic forceps and crushed, then a cat-gut ligature is applied and the portion beyond this ligature is cut away. It is well to ligate the cystic artery when it is severed on the lower surface of the gall bladder. A strand of gauze is placed in the space formed by the removal of the mucous membrane and held in place by fine cat-gut suture and the other end is carried out through the angle of the wound.

Were it possible to say beforehand which cases of stone of the cystic duct will result in a permanent closure of this duct after cholecystotomy has been performed, the indication for the operation which has just been described would be clear, because one could then avoid the necessity of performing a secondary operation.

With increased experience it is likely that every surgeon will be able to select a large number of these cases, and with increased skill he will be able to reduce the difference in the gravity of the two operations to a marked extent.

If an incision is made about half or three-fourths of an inch from the liver through the peritoneum attaching the fundus of the gall bladder, extending in the direction of the gall bladder to a point near the beginning of the cystic duct, both to the inner and the outer side of the gall bladder, the latter can be loosened very readily without causing much hæmorrhage. The gall bladder can then be drawn up into the wound, because it has been thoroughly loosened and the remaining steps of the operation will thus be greatly facilitated.

When the thickened whitish color of the gall bladder indicates that there has been a considerable amount of inflammatory disturbance therein, in any case in which a stone is felt in the cystic duct, it is often best to remove the gall bladder with the stone in place, without having previously emptied it, because in this manner all the infectious material is at once removed and the condition is analogous to the removal of a vermiform appendix containing pus without having opened the sac. This operation is especially indicated in cases in which the impaction of the gall stone in the cystic duct has evidently existed for a considerable period of time, because in such cases the amount of connective tissue which has formed about the cystic duct, because of the long continued irritation, is usually sufficient to cause a closure of this duct after the stone has been removed.

In cases in which a tumor in the region of the gall bladder has persisted for a long time, which proves to be a distended gall bladder at the time of the operation, it is usually wise to choose this operation rather than a cholecystostomy.

No.	Hospital Numbr.	Age.	Sex	Occupation.	Admission.	Discharge.	Durat'n of Disease	Stomach Symptoms.	Colic.	Jaundice.	Complications.	Contents of Gall Bladder.
1	8546	34	F	House work	Jan. 2	Feb. 13	5 yrs.	Bloating and eructation of gas	5 attacks	None	Chronic appendicitis.	12 stones. Thick dark bile.
2	8549	35	F	House work.	Jan. 3	Aug. 15	17 yrs.	Pain in epigastrium after eating. Frequent vomiting.	No severe attacks.	Slight at times.	Chronic appendicitis.	Thick, dark bile.
3	8670	52	F	House work.	Jan. 28	Mar. 15	9 yrs.	None except persistent vomiting with attacks of colic.	Numerous attacks.	None	Obliterative appendicitis.	60gall stones.
4	8717	50	F	None.	Feb. 7	Mar. 14	30 yrs.	Frequent vomiting.	None.	None.	Chronic appendicitis.	Dark, thick fluid, containing sand.
5	8773	57	F	Badge maker	Feb. 20	Apr. 5	1 yr.	Nausea and vomiting. Abdominal distention. Eructation of gas; pain.	None.	Quite marked.	Carcinoma of stomach.	Impacted with gall stones.
6	8794	36	F	House work.	Feb. 25	Mar. 26	14 yrs.	Chronic gastritis for several years.	Numerous attacks.	None	Empyema of gall bladder. Chronic appendicitis.	Purulent fluid. Many small gall stones, varying from size of pea to filbert.
7	8799	35	F	House work	Feb. 26	Mar. 26	1 yr.	Chronic gastritis.	Numerous attacks.	None.	Chr. App. Floating right kidney.	Thick, dark bile, with sand.
8	8823	37	F	House work.	Mar. 3	Mar. 24	12 yrs.	None.	Two attacks.	None.	Chr. App.	Thick, dark bile, with sand.
9	8843	49	M	Machinist.	Mar. 7	Mar. 23	10 days	Pain in epigastrium and vomiting for one week.	None.	None.	Intestinal obstruction.	Impacted with gall stones.
10	8875	36	F	House work.	Mar 13	Mar. 16	5 days		None.	None.	Intestinal obstruction.	Distended with gall stones.
11	8906	30	F	House work.	Mar. 19	Apr. 30	5 yrs.	Pain in epigastrium after eating. Eructation of gas. Chronic gastritis 3 years.	Numerous attacks.	None.	Hemorrhoids.	A fibrous mass at entrance of common duct into duodenum.
12	8994	40	M	Chemist.	Apr 9	Mar. 9	12 yrs.	Pain in epigastrium after eating lasting 2-4 hours. Often regurgitated a mouthful of bitter fluid.	None.	Slightly, a few times.	Chr. App.	Dark bile. Whole lining of gall bladder felt granular.
13	9053	50	F	House work.	Apr. 23	May 23	23 yrs.	Troubled with sick headaches. Pain in epigastrium half an hour after eating.	Two attacks.	Never jaundiced until 4 wks. ago.	Chr. App.	5 large gall stones.
14	9058	41	F	House work.	Apr. 23	May 23	2 yrs.	Symptoms of chronic gastritis.	None.	None.		Dark bile, with sand.
15	9146	43	F	House work.	May 16	June 26	1 yr.	Almost constant burning pain in epigastrium.	None.	None.	Obliterative appendicitis.	Thick, dark bile.
16	9188	23	M	Farmer.	May 25	July 2	2 yrs.	Constant sour stomach. Vomited frequently. Colicky pains after eating.	None.	None.	Chronic appendicitis.	Dark, tarry bile.
17	9214	60	F	House work.	May 30	July 7	10 yrs.	Capricious appetite. Craved sour articles.	Numerous attacks.	Several times.	Empyema of gall bladder. Obliterative appendicitis.	Purulent fluid. 5 gall stones.

DIAGNOSIS.	TREATEENT,	REMARKS.	RESULT.
Gall stones. Chronic appendicitis.	Laparotomy. Removed 12 gall stones. Drained gall bladder. Removed appendix.	Appendix adherent behind cæcum, constricted by adhesion. Mesenteric glands about appendix enlarged.	Recovery.
Cholecystitis.	Laparotomy. Drained gall bladder. Removed appendix.	Gall bladder long and pendulous. Appendix adherent at end; last one inch of lumen obliterated. Middle third filled with fæcal concretions.	Recovery.
Gallstones.	Laparotomy. Removed gall stones and drained gall bladder. Excised remainder of appendix.	Appendix almost obliterated. Just a band of connective tissue remained.	Recovery.
Cholecystitis. Chronic appendicitis.	Laparotomy. Drained gall bladder. Excised appendix.	History indefinite and contradictory. Appendix large, adherent.	Recovery.
Gall stones and carcinoma of stomach.	Laparotomy. Gastroenterostomy, with Murphy button. Removed gall stones, drained gall bladder.	Vomiting stopped after operation, but patient was never able to be about. Died from exhaustion.	Died six weeks after operation.
Gall stones. Empyema of gall bladder. Chronic appendicitis	Laparotomy. Removed gall stones, drained gall bladder. Excised appendix.	Appendix doubled on itself by adhesions. Distinct history of severe appendicitis three years ago.	
Cholecystitis. Floating Kidney. Chronic appendicitis.	Laparotomy. Drained gall bladder. Anchored kidney to parietal peritoneum. Excised appendix.		Recovery.
Cholecystitis. Chronic appendicitis	Laparotomy. Drained gall bladder. Excised appendix.	Appendix universally adherent.	Recovery.
Gall stones. Intestinal obstruction. Diffuse fat necrosis.	Laparotomy. Removed gall stones and drained gall bladder.	Found gall bladder severely inflamed and filled with impacted gall stones. Pancreas swollen and inflamed. Diffuse fat necrosis in omentum. Patient improved slightly after op., but died on 15th day after op. from intestinal hemorrhage.	
Gall stone. Intestinal obstruction. Diffuse peritonitis.	Laparotomy. Removed gall stones. Drained gall bladder. Punctured colon and removed large amount of fæcal matter.	Patient entered hospital in extremely bad condition, which was steadily getting worse. She would have been more likely to recover had she been treated with gastric lavage and exclusive rectal feeding.	Died three days after operation.
Biliary obstruction.	Laparotomy. Duodenum incised longitudinally, small fibrous mass removed. Wound in duodenum closed transversely. Lining membrane of gall bladder dissected out,ligated near cystic duct. Wound drained.	Two years ago patient had appendix removed. One year ago had one large gall stone removed.	Recovery.
Cholecystitis. Chr. appendicitis. Chr. pancreatitis.	Laparotomy. Drained gall bladder. Excised appendix.	Appendix club-shaped. Constriction near cæcal end. Head of pancreas enlarged. Lymphatics along common duct enlarged.	Recovery.
Gall stones. Chronic appendicitis.	Laparotomy. Removed 5 gall stones. Drained gall bladder. Excised appendix.	Appendix sausage-shaped and contained five fæcal concretions size of a hazel nut.	Recovery.
Cholecystitis.	Laparotomy. Drained gall bladder.	Mesentery full of nodules. Carcinoma(?) Tuberculosis(?)	Recovery.
Cholecystitis. Obliterative appendicitis.	Laparotomy. Drained gall bladder Excised remnant of appendix.		Recovery.
Cholecystitis. Chronic appendicitis.	Laparotomy. Drained gall bladder. Excised appendix.	Appendix contained six fæcal concretions.	Recovery.
Gall stones. Empyema of gall bladder. Obliterative appendicitis.	Laparotomy. Removed 5 gall stones. Drained gall bladder. Excised remnant of appendix.		Recovery.

No.	Hospital Number.	Age.	Sex.	Occupation.	Admission.	Discharge.	Durat'n of Disease.	Stomach Symptoms.	Colic.	Jaundice.	Complications.	Contents of Gall Bladder.
18	9269	43	F	Physician.	June 11	Oct. 2	1 yr.	Solid foodcaused discomfort all through abdomen, with nausea. Frequent vomiting.	Never severe.	None.	Chr. App.	Mucus. Solitary gall stone size of pigeon egg.
19	9289	50	M	Banker.	June 16	July 18	7 yrs.	None.	Six attacks.	Marked.	None.	Thick, dark bile. One gall stone size of Eng. Walnut.
20	9308	51	F	House work.	June 20	June 29	1 yr.	Indigestion. Pain in epigastrium one hour after eating. Gradually growing worse.	Two attacks.	None.	Empyema of gall bladder.	Pus and impacted gall stones.
21	9316	34	F	House work.	June 22	Aug. 25	11 yrs.	Often nauseated	Numerous attacks.	None.	Chronic appendicitis. Salpingitis.	4 gall stones. Thick, tarry bile.
22	9330	38	F	House work.	June 26	Aug. 9	2 yrs.	Discomfort after eating; feeling of fullness, abdominal distention, eructation of gas, regurgitation of sour fluid.	None.	None.	Chlorosis.	Thick, dark bile, with sand.
23	9373	52	F	House work.	July 6	July 28	One wk.	Four severe attacks of pain in epigastrium past week.	No real gall stone colics.	Slightly.	None.	Greatly distended with thick, dark bile.
24	9521	59	M	Tailor	Aug. 8	Oct. 27	3 yrs.	Almost constant pain in epigastrium.	Several slight at tacks none severe.	None.	Pancreatitis.	Thick, dark bile. Sand. Several small gall stones
25	9530	40	F	House work.	Aug. 11	Sep. 22	7 yrs.	Distention of abdomen. Eructation of gas after eating. Appetite poor.	Seven attacks	None.	Extensive adhesions.	Solitary gall stone size of pigeon egg.
26	9551	55	F	House work.	Aug. 4	Oct. 29	2 yrs.	Eructation of gas. Pain in epigastrium after eating. Often nauseated.	One slight attack 7 weeks ago.	Marked	None.	Distended, with thick, dark bile, containing sand. One gall stone size of English walnut.
27	9267	21	F	House work.	June 11	July 21	3 yrs.	None.	Numerous attacks.	Severely jaundiced 4 m's ago.	Recurrent appendicitis.	Distended with bile.
28	9348	50	F	Dressmaker	June 30	Aug. 21	4 mos.	None.	5 attacks.	With each attack.	Recurrent appendicitis.	Adherent and greatly distended with bile.
29	9572	57	F	House work.	Aug. 20	Sep. 1	10 yrs.	Subject to attacks of vomiting. Constipation. Pain in epigastrium past 8 mos.	None severe.	Slightly.	Carcinoma of liver.	Impacted with gall stones.
30	9649	36	F	House work.	Sep. 3	Aug. 14	9 yrs.	Greatly troubled with eructations of gas. Pain after eating. Always vomits heavy meal.	Numerous.	Many times.	Chronic appendicitis. Cyst of left ovary.	Small stricture one-half inch from distal end. One gall stone.
31	9668	24	M	Office.	Sep. 8	Oct. 12	11 yrs.	None.	Numerous attacks.	Slight many times.	Recurrent appendicitis.	Small, contracted. One stone in common duct.
32	9694	42	F	House work.	Sep. 12	Oct. 27	3 yrs.	Sense of fullness after eating. Constipation.	Numerous attacks.	Slightly once.	Empyema of gall bladder.	Greatly distended with pus and gall stones.

DIAGNOSIS.	TREATMENT.	REMARKS.	RESULT.
Gall stones. Chr. appendicitis.	Laparotomy. Removed gall stone. Drained gall bladder. Excised appendix.		Recovery.
Gall stones.	Laparotomy. Removed gall stone. Drained gall bladder.	The wall of the gall bladder was greatly thickened and closely applied to surface of gall stone.	Recovery.
Gall stones. Empyema of gal l bladder.	Laparotomy. Removed great many stones from gall bladder. 8 stones from common duct. 3 from cystic duct.	Gall bladder was adherent to stomach, and was so contracted that could not sew to peritoneum. Patient was greatly weakened. Her temperature remained normal, but she died of exhaustion 5 days after operation.	Died 5 days after operation from exhaustion.
Gall stones. Chr. App. Salpingitis.	Laparotomy. Removed 4 gall stones and several small fragments. Excised appendix. Excised both Fallopian tubes.	Appendix adherent, almost obliterated. Both tubes adherent, congested and closed at ends	Recovery.
Cholecystitis. Chlorosis.	Laparotomy. Drained gall bladder. Excised appendix.	Patient gained in weight and color while recovering from the operation.	Recovery.
Cholecystitis.	Laparotomy. Drained gall bladder. Excised appendix, incidentally.		Recovery.
Gall stones. Pancreatitis.	Laparotomy. Removed gall stones. Drained gall bladder.	Gall bladder was considerably distended. Pancreas enlarged.	Recovery.
Gall stones.	Laparotomy. Removed gall stone and pus. Drained gall bladder.	Liver, stomach, pancreas and intestines all a mass of adhesions. No attempt to loosen adhesions. Made incision directly through lower end of right lobe of liver and opened into gall bladder, which was adherent on under surface. Glass drain placed through liver into gall bladder. Peritoneum protected by placing iodoform guaze pads between liver and peritoneum.	Recovery.
Gall stones.	Laparotomy. Removed gall stone. Drained gall bladder.	Had several severe hæmorrhages from gall bladder during three weeks following operation. Controlled by tamponing with gauze saturated with adrenaline solution, 1-1000.	Recovery.
Recurrent appendicitis. Adhesion of gall bladder.	Laparotomy. Excised appendix. Drained gall bladder.	Appendix adherent, curled upon itself. Gall bladder greatly distended with bile; pendulous.	Recovery.
Recurrent appendicitis, with acute cholecystitis.	Laparotomy. Excision of appendix.	Appendix thick, congested, adherent; had been perforated one inch from distal end. Did not disturb gall bladder on account of weakened condition of patient.	Recovery.
Gall stones. Carcinoma of liver.	Exploratory laparotomy.	Found gall bladder impacted with gall stones. Liver enlarged and covered with carcinomatous nodules. Recovered from operation, but was not benefited.	Recovery.
Gall stones. Chronic appendicitis. Ovarian cyst.	Laparotomy. Removed gall stone Drained gall bladder. Excised appendix and left ovary and tube.	Distal half of appendix cicatricial. Omentum adherent to gall bladder. The left ovary contained a cyst the size of an orange.	Recovery.
Gall stones. Recurrent appendicitis.	Laparotomy. Removed gall stone from common duct.	Appendix adherent and curled upon itself. Unable to bring gall bladder up to peritoneum, so sutured iodoform gauze pads to posterior surface of gall bladder and brought out through wound.	Recovery.
Gall stones. Empyema of gall bladder.	Laparotomy. Removed gall stone. Drained gall bladder.	Gall bladder large as a fist.	Recovery.

No.	Hospital Number.	Age.	Sex.	Occupation.	Admission.	Discharge.	Durati'n of Disease.	Stomach Symptoms.	Colic.	Jaundice.	Complications.	Contents of Gall Bladder.
33	9707	40	F	House work.	Sep. 16	Nov. 13	7 yrs.	Almost constant pain, relieved somewhat by presence of food.	None.	None.	Fibroid of uterus. Cysts of both ovaries.	Two gall stones size of hickory nuts .
34	9758	30	M	Laborer.	Sep. 29	Oct. 28	7 mos.	Eructation of gas. Heaviness in stomach after eating.	None.	Very marked.	Acute appendicitis.	Greatly distended and inflamed.
35	9788	40	F	House work.	Oct. 3	Nov. 18	4 yrs.	None.	13 severe attacks.	Marked.	None.	Nine gall stones.
36	9811	48	F	House work.	Oct. 8		Several yrs.	Chronic gastritis.	None.	None.	Movable kidney.	Greatly distended with bile.
37	9819	57	F	House work	Oct. 10	Nov. 10	4 yrs.	None.	About 20 attacks.	Slightly once.	None.	Contained 1,330 gall stones. Size, millet seed to large as pea.
38	9846	42	M	Minister.	Oct. 19	Nov. 18	2 yrs.	None.	8 attacks.	Slightly twice.	Chronic appendicitis.	Small and shrunken, lined with granulation tissue.
39	9859	38	F	House work.	Oct. 21	Nov. 18	29 yrs.	Eructation of gas. Constipation. Pain in epigastrium.	Numerous.	Many times.	Pyloric obstruction. Empyema of gall bladder. Chr. App.	Pus. Several gall stones.
40	9866	50	F	House work.	Oct. 22		Several yrs.	Distress after eating and eructation of gas.	None.	Slightly.	Renal calculus. Pyosalpinx. Appendicitis. Epithelioma of ch'k.	Seventeen gall stones.
41	9872	31	F	House work.	Oct. 24		6 mos.	Eructation of gas. Bloating after eating.	None.	None.	Chronic appendicitis.	Black bile, with sand.
42	9892	39	F	House work.	Oct. 29		10 yrs.	Eructation of gas. Often nausea.	None.	None.	Chronic appendicitis.	Thick, black bile. 5 large stones.
43	9896	33	F	House work.	Oct. 29		3 yrs.	Considerable distress in epigastrium, more marked after eating.	None severe.	None.	Cyst of both ovaries.	One gall stone.
44	9926	53	F	House work.	Nov. 6		2 mos.	Food is repugnant. Very constipated.	None.	None.	Chronic appendicitis. Uterine polypus.	Distended with thick, tarry bile.
45	10,-020	64	F	None.	Dec. 1		1 mo.	Constipated. Appetite irregular.	None.	None.	Left femoral hernia. Empyema of gall bladder. Abscess in abdominal wall.	Pus. 50 gall stones.
46	10,-035	49	M	Tailor	Dec. 3		3 yrs.	Distress in epigastrium after eating heavy m'l.	Three mild attacks.	None.	Cæcum adherent to anterior parietal peritoneum.	29 gall stones. Some pus.
47	9915	63	M	None.	Nov. 4	Dec. 1	Several yrs.	Nausea. Distress after eating. Eructation of gas. Occasional vomiting.	None.	None.	Carcinoma of splenic flexure of colon, with perforation and abscess.	18 gall stones and greatly distended with bile.
48	10,-012	31	M	Laborer.	Nov. 28	Dec. 29	3 wks	Suffered frequently from nausea and from indigestion.	Almost constant severe attacks.	Marked.		Very small. Contained clear bile.

DIAGNOSIS.	TREATMENT.	REMARKS.	RESULT.
Gall stones. Fibroid of uterus. Ovarian cyst.	Laparotomy. Removed gall stones. Drained gall bladder. Abdominal hysterectomy. Removed both ovaries and tubes Removed appendix, incidentally		Recovery.
Acute appendicitis, with cholecystitis.	Laparotomy. Excision of appendix.	Appendix in shape of question mark, severely congested. Gall bladder greatly distended with bile; not disturbed on account of bad condition of patient. Will probably require cholecystotomy at some future time.	Recovery.
Gall stones. Cholecystitis.	Laparotomy. Removed gall stones. Drained gall bladder.		Recovery.
Cholecystitis. Movable kidney	Laparotomy. Anchored kidney. Drained gall bladder.	Gall bladder adherent to stomach and greatly distended with bile. Obstruction to common duct due to adhesions.	Recovery.
Gall stones.	Laparotomy. Removed gall stones. Drained gall bladder.		Recovery.
Cholecystitis. Chr. App.	Laparotomy. Drained gall bladder. Excised appendix.	Appendix contained fæcal concretions. Constriction near middle.	Recovery.
Gall stones. Empyema of gall bladder. Pyloric obstruction. Chr. App.	Laparotomy. Removed gall stones. Drained gall bladder. Gastroenterostomy. Excised appendix.	Appendix long, congested, constricted. Gall bladder, liver, stomach and intestines all adherent.	Recovery.
Pyonephrosis. Gall stones. Chr. App. Epithelioma cheek.	Laparotomy. Removed gall stones. Excised appendix. Excised epithelioma. Removed right kidney.	Appendix adherent posteriorly; contained fæcal concretions. Constricted pelvis of right kidney contained irregular stone 1½ inches long.	Recovery.
Cholecystitis. Chr. App.	Laparotomy. Emptied gall bladder. Dissected out mucous membrane of gall bladder. ligated and drained. Excised App.	There was a valve-like constriction of gall bladder near opening of cystic duct. App. adherent, bent, constricted and full of fæcal concretions.	Recovery.
Gall stones. Chr. App. Salpingitis. Hypertrophied uterus.	Laparotomy. Removed gall stones. Drained gall bladder. Abdominal hysterectomy. Excised both ovaries and tubes. Excised appendix.	Appendix full of fæcal concretions. A hematosalpinx on right side.	Recovery.
Gall stones. Ovarian cysts.	Laparotomy. Removed gall stone. Drained gall bladder. Left ovary and tube excised. Right ovary resected. Ovarian cysts the size of hen's egg.		Recovery.
Cholecystitis. Chr. App. Uterine polypus.	Laparotomy. Drained gall bladder. Excised appendix. Removed uterine polypus	Appendix had two concretions, one a half inch from distal end, the other half an inch from that. Appendix completely occluded between these points.	Recovery.
Gall stones. Empyema of gall bladder. Perforation of gall bladder into abdominal wall.	Laparotomy. Removed gall stones and drained gall bladder. Incised abscess in abdominal wall and removed 17 gall stones from same.	Gall bladder had perforated into abdominal wall in median line two inches below umbilicus. There were 17 gall stones in the abdominal wall at that point.	Died 12 days after operation from exhaustion; normal temperature,but never gained any strength after operation.
Gall stones. Peritoneal adhesions.	Laparotomy. Excision of gall stones. Drained gall bladder. Loosened adhesions.	Patient had appendix removed two years ago, but symptoms still persisted.	Recovery.
Gall stones. Carcinoma of colon, with perforation and abscess.	Incision and drainage of abscess. 18 days later made an anastomosis between sigmoid and ascending colon. Removed gall stones and drained gall bladder.		Died; shock.
Adhesions and cicatricial stenosis of common duct.	Laparotomy. Separated adhesions. Excised gall bladder. Dilated stricture of common duct Placed rubber tube in common duct and sutured in place for drainage. Drained space underneath liver posteriorly.	Had laparotomy and several gall stones removed in 1897. Perfectly well until two days before admission to hospital.	Died of perforation of duodenum on the 10th day.

CHOLECYSTITIS, PANCREATITIS, PYLORIC OBSTRUCTION.

The patient under consideration, a married woman, sixty years of age, gives the following history:

Family History.—One sister died of pulmonary tuberculosis at the age of eighteen. All the other members of her family have been healthy. She experienced the ordinary diseases of childhood; menstruation at fifteen, regular and painless. From the age of twenty to twenty-three she was practically an invalid, lost in weight, suffered from cough, and was scarcely able to be about. After this she was well for seven years. She was married at twenty-three, had four normal pregnancies followed by three miscarriages, with the last one of which—at the age of thirty—she was severely ill. This was followed by some lung trouble, the exact character of which she cannot state. At this time she suffered severely from pain in the right hypochondriac region, which was supposed to be due to enlargement of the liver. This pain subsided after about one year. Patient suffered from double femoral hernia for a number of years. One of these became strangulated two years ago, necessitating an operation. At the same time an operation was performed for the radical cure of the other hernia.

Five years ago patient suffered from what was supposed to be an attack of acute gastritis. She had pain and feeling of weight in the vicinity of the stomach after eating, accompanied by eructations of gas; this was followed by vomiting, which persisted for one week. She had similar attacks every few months until she underwent the operation for the cure of her herniæ. After this she was free from these attacks for five months, when they returned, becoming more severe. She has been confined to her bed for six weeks. There has been constant pain in the epigastrium and in the right hypochondriac region during the past two months and the patient has had almost daily attacks of vomiting.

Three weeks ago the patient was placed on exclusive rectal feeding. Since that time the pain has decreased, but she has not been entirely free from distress, and she has vomited almost every day. The patient has never had typhoid fever and she has never been jaundiced.

Present Condition.—Patient is twenty-five pounds below her normal weight. She is anæmic, but not cachectic. Temperature 98° F., pulse 80, and regular. Heart, lungs, kidneys and pelvic organs are normal. There is a moderate amount of tenderness upon pressure in the vicinity of the gall bladder and pancreas. No tumor can be felt.

Diagnosis.—The conditions which have just been described in the history indicate the presence of some form of obstruction in the vicinity of the pylorus. The age of the patient would suggest the presence of a malignant growth, but the condition has existed so long that it is likely a tumor would be apparent at the present time were the obstruction due to a malignant growth.

Comparing this history with the one in the previous case, the presence of a gastric ulcer can probably be excluded. This would leave only a stricture of the pylorus due to a possible ulcer which may have existed at the time of the patient's illness thirty years ago.

It is also likely that the obstruction caused in this manner may have been only partial and that it was compensated by the hypertrophy of the stomach wall, and that it was only possible for this obstruction to produce serious symptoms since the age of the patient has become advanced.

The fact that there have been distinct paroxysms of pain in the region of the gall bladder and that the pain has been most marked to the right of the median line, and that the only region of tenderness upon pressure is in the vicinity of the gall bladder, would indicate that this region is involved. It consequently seems proper in this case to make a diagnosis of obstruction of the pylorus complicated with cholecystitis, and the latter condition may in turn be complicated with gall stones. If present, the latter must, however, be confined to the gall bladder, because the absence of jaundice would eliminate the diagnosis of gall stones in the common duct.

Indications for Operation.—The fact that continued careful treatment has failed to relieve this patient and that she is constantly losing in weight and strength would be sufficient indication for surgical interference in this case. The absence of a malignant growth causing the condition present makes operative interference more promising. The fact that the patient will continue to be in a less favorable condition for operation as time progresses, because of the failing strength, makes a further postponement undesirable. The relative safety of the necessary operation adds to the indication.

PREPARATORY TREATMENT.—This does not vary from that employed in cases for abdominal operations in general.

OPERATION.—The fact that we expect to encounter conditions which will require operative interference both in the stomach and in the gall bladder will determine the position of the incision. These parts can be reached most conveniently by way of an incision extending through the outer edge of the right rectus abdominis muscle from a point an inch below the costal arch and downwards a distance of about three inches. This incision can be enlarged to any length that may be desired, determined by the conditions found in the abdominal cavity.

We find first a distended gall bladder with thickened, congested walls. This fact confirms the diagnosis of cholecystitis.

We have learned by experience that many cases suffering from cholecystitis also suffer from chronic appendicitis. We can find the appendix through this incision by following the longitudinal band of muscles upon the anterior surface of the ascending colon and cæcum. This leads us to an adherent appendix, the adhesions being to the lower end of the cæcum and to the anterior surface of the iliacus muscle.

It is now best to lengthen the incision downwards in order to obtain more space for removing the appendix. The adhesions are not very firm, but it is not wise to work in the dark. Having enlarged the incision, I will retract the edges of the wound and dissect out the appendix carefully. It will then be removed and the stump disposed of according to the method described in the section upon appendicitis operations.

We next examine the stomach and find that its walls are quite thick and that the organ is nearly twice the normal size, notwithstanding the fact that it has been practically empty for nearly three weeks. This indicates that the organ was greatly distended at the time this treatment with exclusive rectal feeding commenced.

Upon examining the pylorus, especially, I observe a mass at least twice the size of the normal pancreas in the location of this structure. I further notice that although there is a thickening in the region of the pylorus, that this is scarcely sufficient to account for the degree of obstruction from which this patient has suffered, but I find a marked thickening in the wall of the duodenum. This fact, together with the condition found in the gall bladder and in the pancreas, would indicate that there must be present an inflammatory condition, or an ulcer, or a cicatrical constriction of the duodenum at the point at which the common duct empties into this bowel.

A chronic pancreatitis is not a very uncommon complication of cholecystitis, but the present time it does not seem an easy matter to make a positive diagnosis in these cases before operation. In this case, then, we will have to dispose of three conditions, aside from the chronic appendicitis which has already been disposed of, viz.: 1. The obstruction to the passage of food from the stomach into the small intestine; 2. The cholecystitis; 3. The chronic pancreatitis.

It is plain that each one of these conditions can only be relieved by securing perfect drainage for the cavities involved. The stomach can best be drained by means of a gastro-enterostomy, which will secure a free communication between the stomach and the jejunum. This operation will be fully described in succeeding pages.

In order to drain the gall bladder and the pancreas it will be necessary either to make an anastomosis between the gall bladder and the intestine, or to establish an external fistula by attaching the gall bladder to the abdominal wall and opening it.

It would not be safe to make an anastomosis with the duodenum, because this portion of the alimentary canal in this patient is in an inflamed condition. An anastomosis between the gall bladder and the colon has been made in a number of cases and, judging from the reports, it has been eminently satisfactory in its results. In this case, however, the thickened, inflamed gall bladder wall would contraindicate such an operation. Moreover, it is likely that having made a gastro-enterostomy, and thus securing a condition of rest for the duodenum, it is to be expected that the inflammation at the point of entrance of the common duct into the duodenum will soon subside and that then the normal drainage of the gall bladder and the pancreas will again be established.

Upon examining the gall bladder and the common duct by palpation no gall stones can be detected, but the gall bladder does not empty itself upon pressure. It may be that the organ contains pus or mucus, or thick, tar-like bile, which is not fluid enough to be forced through the common duct into the duodenum by the pressure which I have made.

We will first pack away the surrounding viscera by means of moist, aseptic gauze tampons, in order to prevent infection. This is important, because the presence of a normal temperature does not exclude the possibility of finding pus in the gall bladder containing pathogenic micro-organisms.

I will attempt to aspirate the fluid contained in the gall bladder through a trochar 2 mm. in diameter, and find a thick, tar-like substance, which can be aspirated through this trochar only with difficulty. The color is due to a black, sand-like material which is frequently found in chronic cholecystits. This substance frequently occludes the common duct and occasionally gives rise to the most intense attacks of gall stone colic. It is sometimes, though rarely, present in the gall bladder, together with perfectly formed gall stones. We will enlarge the opening in the gall bladder and by inserting long, narrow tampons of moist, aseptic gauze, will remove all of this substance which we have failed to remove by aspiration. The remaining steps of the operation correspond to those described in connection with cholecystostomy.

After Treatment.—The after treatment in general will be the same as described in connection with gastro-enterostomy. The gall bladder will be treated in the same manner as described in connection with cholecystostomy.

Surgery of the Stomach.

GENERAL CONSIDERATIONS.

Stomach surgery at the present time is instituted to a very large extent for the purpose of overcoming faulty drainage of this organ. In various ways the pylorus becomes obstructed, so that the contents of the stomach cannot pass on into the intestine in a normal way and as a result of this there is first a compensatory hypertrophy of the walls, then a dilatation with an accumulation of mucus and remnants of food which are sure to undergo decomposition. This is accompanied with the formation of gas, which will further increase the distention of the stomach. This in turn produces a deformity in the outlines of the stomach, the latter taking the form of a pouch bending downward, and this in turn increases the obstruction to the pylorus, because the food has to be elevated a considerable distance before it reaches the exit.

The normal stomach extends obliquely across the abdominal cavity, the cardiac end being much higher than the pyloric end. The lesser curvature of the stomach extends almost vertically downwards for the first two-thirds of its extent, slanting only very slightly toward the right, beginning at the point of entrance of the œsophagus, almost the entire curve being confined to the third nearest the pylorus. The greater curvature is more uniform and extends across the abdomen at an average angle of about 45°. It is important to bear this in mind, because it explains to a great extent the increase in the obstruction resulting from the element of dilatation, which is in itself the result of an obstruction to the pylorus. It further explains some of the unsatisfactory conditions which are apt to persist after the primary obstruction of the pylorus has been relieved by a plastic operation to enlarge this orifice.

The pylorus which has been thus enlarged would readily permit the stomach contents to pass if the stomach still had its normal form and position, but with the greater curvature forming a deep pouch, which has resulted from the obstruction, the emptying of this organ is greatly interfered with, even if the constriction of the pylorus no longer exists.

Clinical History.—The patient before us is a seamstress, twenty-one years of age, married. She gives the following history: Her parents, brothers and sisters are well. As a child she had measles. Her menstruation has been regular but scant, and at times very painful, since the age of seventeen. At the age of fifteen she began to experience a dull pain in the epigastrium, which continued from a few hours to a week at a time. She experienced nausea, but rarely vomited. She had no fever, but suffered somewhat from constipation. She thinks that this pain was not caused by eating.

For several years these dull pains were initiated by a severe paroxysm, which recurred at intervals varying from three weeks to six months. She has had three of these paroxysms during the past year, each one beginning with vomiting. The last attack began six weeks ago. She had an exacerbation a few hours after entering the hospital yesterday. The acute pain lasted but three hours Each time of late the paroxysm began with a severe pain in the epigastric region and extended into the back and up under the left shoulder blade. There are constant eructations of gas and for a few hours after eating eructations of extremely acid fluid. She usually eats nothing for a few days after the beginning of an acute attack. The fæces have a dark brown or black color for several days after one of these attacks.

Twelve hours ago a severe pain radiated from the epigastrium around the right costal arch and down the right side of the abdomen for the first time since the beginning of her sickness.

Present Condition.—Very anæmic, skin waxy, tongue coated, appetite poor, and directly after eating she has pain in epigastrium which may persist for an hour. Sometimes eating does not cause pain, and at times there is pain without eating. All lobes of the thyroid gland are slightly enlarged, there is no tachycardia, no exophtalmus. Temperature normal, pulse 80, regular, weak, small, rapid. Heart and lungs are normal. There is a trace of albumen in the urine and a few blood corpuscles. There is tenderness upon pressure in the epigastric region. The stomach sound on percussion indicates great dilatation extending to a point two inches below the umbilicus. Upon shaking the abdomen there is a distinct splashing sound.

Diagnosis.—The history in this case seems to indicate clearly that the patient suffered primarily from an ulcer of the pyloric end of the stomach. The hyperacidity of the stomach, followed later on by pain upon taking food, and this by a slight amount of nausea after each meal, which resulted in vomiting at the beginning of each one of the more severe acute attacks. After this the patient gradually become more and more anæmic. At times she felt quite faint; she suffered from gaseous distention of the abdomen. Throughout this time the patient was troubled with constipation, but during the latter part of the time the fæces were at times perfectly black, indicating that there must have been a certain amount of hæmorrhage, as she had taken no medicine which might have caused the discoloration of the fæces. The abdomen is painful upon pressure over the region of the pylorus.

For a considerable time the patient suffered from pain which she located in the vicinity of the left shoulder blade, indicating that the ulcer must have existed on the posterior wall of the stomach, probably implicating the pancreas secondarily.

Under treatment the acute symptoms subsided, but secondary symptoms, notably those of pyloric obstruction, began to appear. Constipation became more obstinate. Her appetite diminished, she continued to lose in weight, the gaseous distention increased.

Physical examination demonstrated a greatly distended stomach. Succussion demonstrated the presence of fluid in the stomach, which upon removal with the stomach tube is shown to consist of mucus and remnants of food.

She has been constantly under medical treatment, but this has given only partial relief. It is probable that it has resulted in the healing of the gastric ulcer, but the cicatricial contraction following this has resulted in a partial obstruction of the pylorus.

Differential Diagnosis.—The conditions we have found are not unlike, in many ways, those which we have described in connection with the presence of gall stones or chronic appendicitis. They differ especially in the fact that the point which is tender to pressure is in the epigastric region, that the pain has been confined to this point except when it has radiated up under the left shoulder blade. It has never radiated to the right until a few hours ago and then downward and not up around the tenth rib to the right. There is no tenderness upon pressure over the gall bladder or the appendix. This will eliminate gall stones and appendicitis. There is no jaundice, but very marked anæmia, pain in epigastric region after eating, dilatation of stomach, eructation of gas, stasis of food as shown by gastric lavage. We may consequently safely make a diagnosis of incomplete obstruction of the pylorus due to gastric ulcer, which may have partially healed, resulting in a certain amount of cicatricial contraction.

Indications for Operation.—This patient has been under medical treatment for six years. Her condition has improved at times, only to relapse. She has consequently arrived at a point where she is willing to undergo any form of treatment which can reasonably promise her permanent relief.

If our diagnosis is correct this can be accomplished only by overcoming the obstruction to the passage of food from the stomach into the intestine, because so long as this obstruction remains there will be residual substance in the stomach and this will favor decomposition which will in turn prevent the healing of the gastric ulcer.

Preparatory Treatment.—In many of these cases, which are not sufficiently strong to bear an operation well, because of their impaired nutrition, together with the anæmia caused by the loss of blood, it is wise to treat the patient before undertaking the operation. It is well in these cases to remove all decomposing substances from the stomach and intestines by the administration of castor oil, given in the manner described before in the foam of beer or extract of malt, in doses of two ounces. I have used this in many of these cases and have never seen the slightest harm result from it, but have constantly observed great benefit. Then it is well to permit the stomach to rest completely for one or two weeks, or even longer, and to give nourishment by nutrient enemata. Mild saline laxatives may be given by mouth because this will facilitate the healing of the gastric ulcer and will at the same time prevent constipation.

Pure olive oil given at bedtime in doses of two ounces seems to aid in building up the patient and at the same time leave the ulcerated stomach without giving rise to any irritation.

If there are no acute symptoms it is well to cocainize the pharynx well by spraying it with a four per cent. solution of cocain. The patient should be permitted to swallow a little of this in order to anæsthetize the œsophagus. After waiting about four minutes, in order to give the cocain an opportunity to take effect, irrigate the stomach thoroughly with normal salt solution.

If there are any symptoms of acute inflammatory disturbance in the lining of the stomach it is better to avoid gastric lavage, because this might give rise to hæmorrhage from an ulcer.

It is not best to inflate a stomach with gas so long as one suspects the presence of an ulcer for fear of perforation, but this is necessary in order to determine positively the extent of gastric dilatation. It is safest to insert a stomach tube for the purpose of distending the stomach with gas and to attach it to an ordinary rubber bulb with which air can be pumped into the stomach slowly and consequently safely. After the degree of dilatation has been determined the gas may be permitted to escape through the tube.

Operation.—If the diagnosis positively excludes every other condition beyond the presence of pyloric obstruction, the most convenient incision extends through the median line from a point one inch below the ensiform cartilage of the sternum to a point one inch above the umbilicus. Through this incision it is very easy to bring into view the pylorus and, indeed, the entire stomach. Grasping the pylorus between the finger and thumb it is possible to feel the cicatricial tissue which obstructs the passage between the stomach and the duodenum. Upon close examination this cicatricial tissue can be observed to shine through the peritoneal covering at this point. The stomach is large and there is a distinct pouch on the greater curvature a short distance from the pylorus. Should we attempt to enlarge the pylorus by means of a plastic operation our incisions and the subsequent suturing would have to extend through cicatricial tissue to a great extent and the result would consequently not be satisfactory. In these cases it is, therefore, usually wiser to secure a communication between the stomach and the small intestine at some distance from the pylorus, where the tissues are perfectly normal. It is wise to choose the most dependent portion of the stomach for this purpose, because this will secure a more perfect drainage than could be accomplished in any other way, the walls of the stomach forming a kind of funnel in which all of the sides slope down to the point of anastomosis.

It then becomes necessary to find the intestine with which to make the anastomosis. This can be accomplished best by lifting the transverse colon, together with the omentum, and the lower edge of the stomach, out of the abdominal wound and observing the point a little to the left of the median line at which the small intestine passes down behind the stomach and the transverse colon. This is brought up out of the abdominal wound and a point selected twelve to sixteen inches from the mesentery of the transverse colon. A small, longitudinal incision is made through the peritoneum and muscular coat down to the mucous coat, then a purse-string stitch is applied, as shown in Plate XXXIVa. Then the mucous membrane is cut and the larger segment of a Murphy button is inserted and the purse-string suture carefully tied. It is important to apply the purse-string suture close to the edge of the wound in the intestine, in order to prevent the tissues being drawn together in irregular masses around the button.

By drawing a small bunch of moist cotton through the hole in the button sufficiently firm to prevent leakage much annoyance can be avoided, because this pledget of cotton can be easily removed before uniting the two lobes of the button. This intestine with the button in place is now surrounded with a piece of moist gauze and placed to one side while the other half of the button is inserted into the stomach in very much the same way.

We have selected the most dependent portion of the greater curvature of the stomach, but here we find the large artery, the gastro-epiploic, Plate XXXIVb, with its large branches extending at right angles with the greater curvature of the stomach. We will select a point half way between two of these branches and will make our incision through the peritoneal and muscular coat down to the mucous coat. The muscular coat will retract somewhat, and here again we will exercise the same care in inserting the purse-

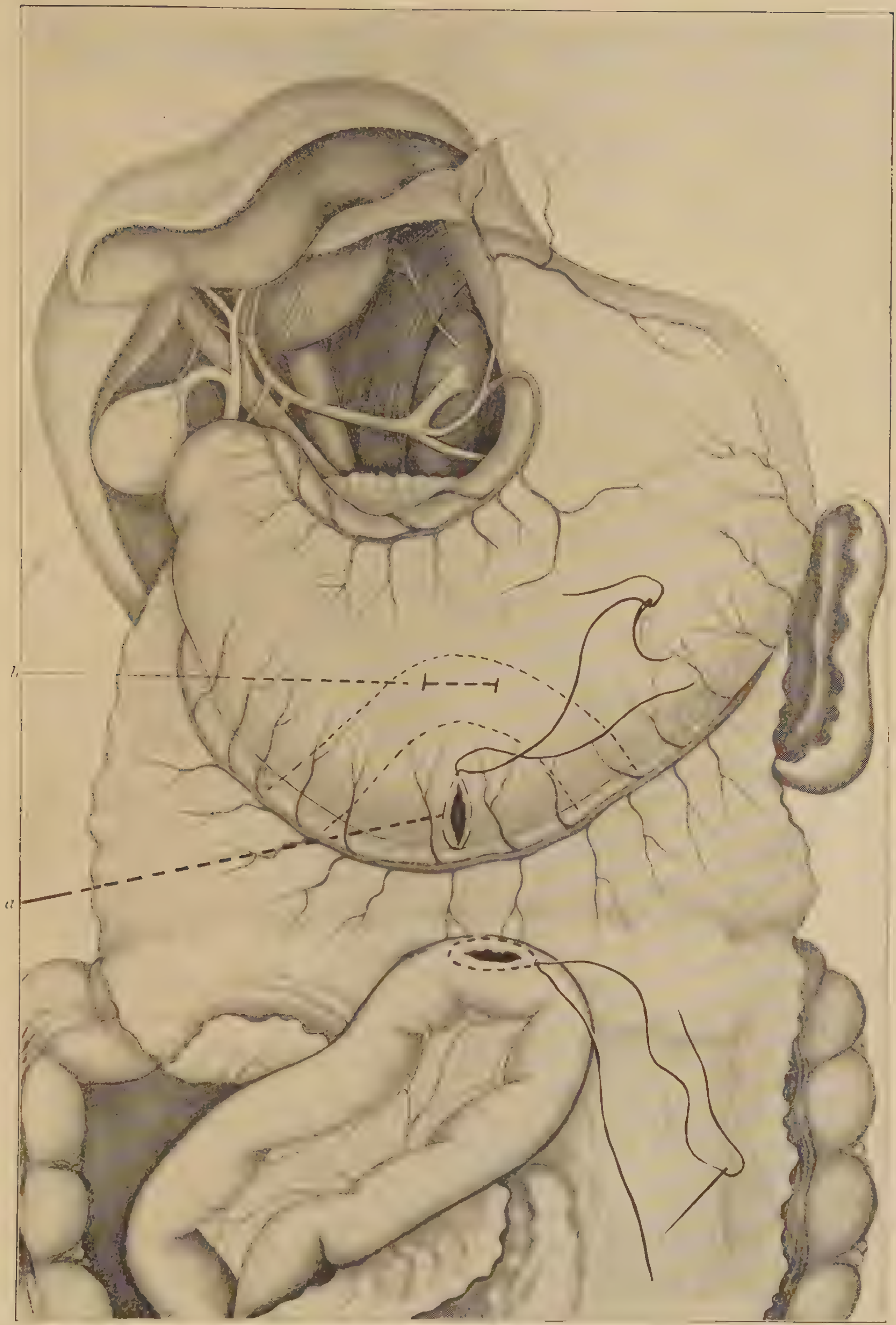


PLATE XXXIV.
GASTRO-ENTEROSTOMY.

Represents anterior gastro-enterostomy with the sutures in place, both around the incision in the jejunum and the one at the lowest point in the stomach; (a) represents the proper position for uniting the intestine to the stomach; (b) represents the usual position, which is wrong, giving rise to vomiting, because it forms a pouch into which the contents of the jejunum may empty.

Taken from Dr. W. J. Mayo's original drawing.

string suture near the edge of the wound, in order not to draw too much tissue between the rims of the button. The smaller segment of the button is now inserted and the purse-string suture tied. It has been so applied as to avoid having the knots in the two sutures meet when the button has been closed. After withdrawing the pledget of cotton from the opening, the two segments of the button are adjusted to each other and pressed together with a moderate amount of force, care being taken to push in any small portion of serous surface which might not have adjusted itself spontaneously.

The surface is then carefully sponged off and the stomach, together with the attached intestine, is dropped into the peritoneal cavity. It is apparent at once that the stomach must drain into the intestine.

It is especially important to select so low a point in the stomach, because this will prevent the bile and pancreatic juice from running into the viscus, which is an exceedingly unpleasant complication that frequently occurs when the incision in the stomach is made a little higher on the anterior surface.

Another very important point is in the selection of the proper point in the small intestine. If a point too near the pylorus is chosen, the small intestine is placed in a condition of tension and this is likely to obstruct the lumen of the gut. The obstruction in the pylorus will prevent the stomach contents from passing through that opening which will serve to preserve the passage between the stomach and the intestine which has just been accomplished. This will secure a perfect drainage of the stomach, disposing of all residual substance, and consequently the organ will soon become normal. Moreover, there will no longer be an opportunity of absorbing products of decomposition from the residual food and mucus in the stomach, hence we may expect not only an improvement in this patient's nutrition, but also a disappearance of the condition which approaches a mild form of septic infection, usually described as auto-infection.

After Treatment.—The after-treatment is the same in gastro-enterostomy for this condition as in the same operation for any other condition. The patient receives nourishing enemata, consisting of one ounce of one of the various reliable predigested foods in the market in three ounces of normal salt solution every four hours. She also receives small sips of very hot water frequently repeated for five to ten days after the operation. At the end of this time she receives milk and lime water and general liquid diet by mouth. The food is increased after the end of the second week, reaching full diet at the end of the fourth or fifth week.

Occasionally it happens that the lumen of the Murphy button becomes occluded, because of clogging with mucus. In this case the stomach is likely to contain a certain amount of bloody mucus, which may give rise to nausea and vomiting. This substance soon decomposes and the patient may become quite ill on account of absorbing products of decomposition. Whenever one suspects an accumulation in the stomach after this operation, the pharynx should be cocainized, a stomach tube inserted and gastric lavage performed thoroughly, warm normal salt solution being employed for this purpose. There is no danger in doing this, provided one guards against retching by the use of cocain and is careful not to overdistend the stomach. These patients will improve very rapidly after the use of gastric lavage and it is often surprising to find how much fluid will accumulate in a stomach after this operation.

As soon as the patient feels strong enough to be supported in a sitting or semi-recumbent position in bed by help of a head rest, it is well to place him in this position, because this facilitates the drainage of the stomach and at the same time serves as a prophylactic measure against the occurrence of hypostatic congestion of the lungs, which is likely to occur in these cases, especially if the patient is somewhat advanced in years. It is frequently possible to have these patients supported in a sitting position on the day following this operation.

CARCINOMA OF THE PYLORUS WITH OBSTRUCTION.

The patient before us is a married woman, thirty-five years of age, giving the following history: Her family history is negative. She suffered from measles as a child, menstruated at seventeen, regularly, but painful, before the time of her marriage at the age

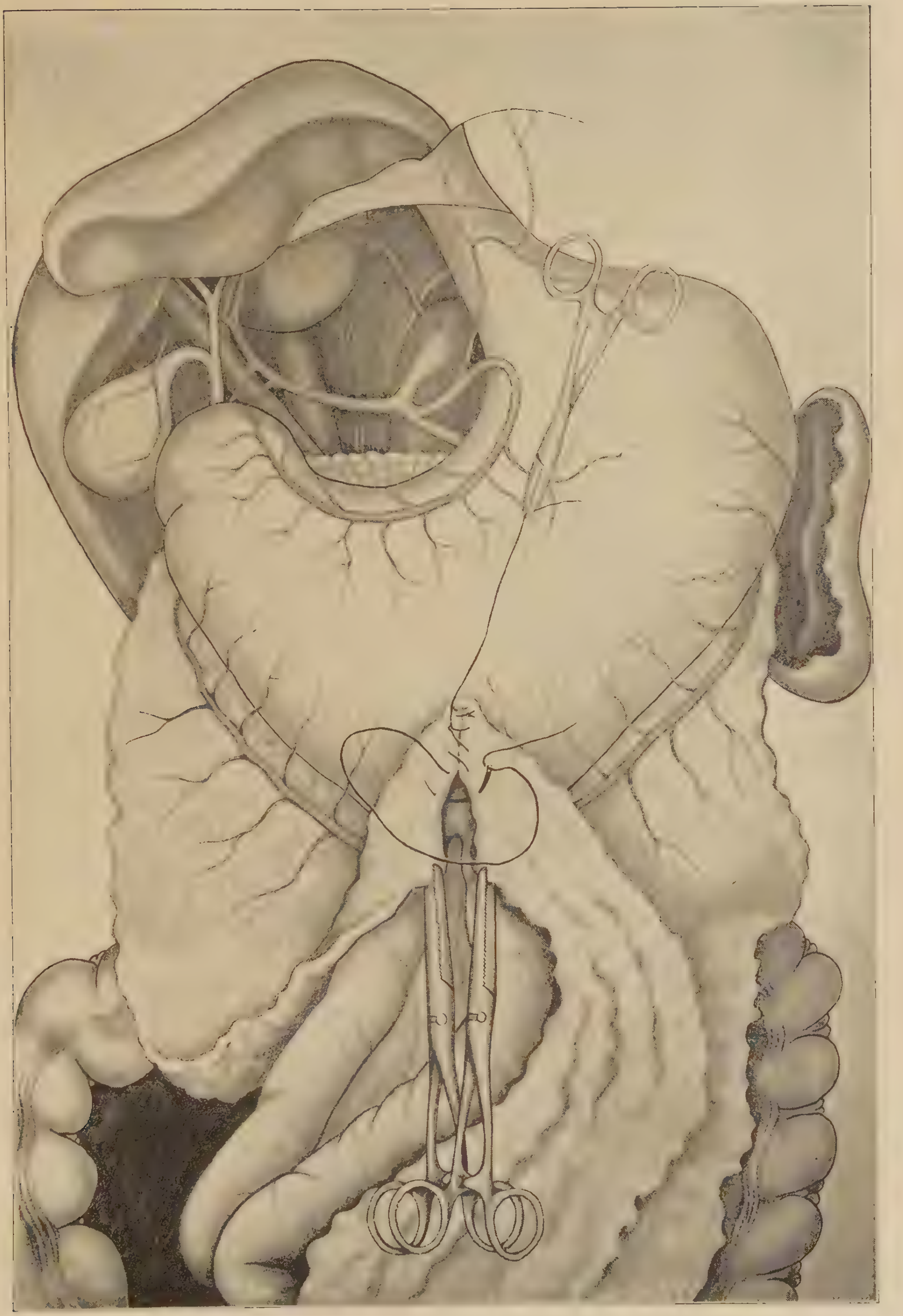


PLATE XXXV.

GASTRO-ENTEROSTOMY.

Represents anterior gastro-enterostomy with the omentum folded over the point of union between the stomach and the jejunum to increase the safety of the operation. Taken from Dr. W. J. Mayo's original drawing.

of twenty-eight. One year later she had a miscarriage, but has otherwise been in good health. Five months ago, patient began to suffer from acid stomach and from the presence of a feeling of fullness after eating, accompanied with eructations of gas. She has also suffered severely from constipation. For the past two months she has vomited, usually after taking solid food, occasionally, however, she would retain any kind of food in her stomach for two or three days and then vomit all that she had taken during this period of time. She has not suffered any pain and her temperature has been normal. She has occasionally been slightly jaundiced. The patient has never been very well nourished.

Present Condition.—The patient is quite emaciated, being fifteen pounds below her usual weight; her tongue is coated and she is very hungry; her bowels are constipated. Cathartics give rise to nausea. Her temperature is 98° F., the pulse 86, regular and fairly strong. Heart, lungs and kidneys are normal. The abdomen is distended, but not tender upon pressure. There is no free fluid in the peritoneal cavity. The stomach is prolapsed and distended, the lower border extends two inches below the umbilicus. Succussion sounds are marked upon shaking the abdomen. A hard, elliptical body, movable with respiration, can be felt in the right lumbar region. There is a tympanitic space between this mass and the costal arch. The mass is movable in every direction.

Diagnosis.—The history would indicate beyond a doubt that there exists in this case an obstruction of the pyloric end of the stomach. This may be due to the presence of a malignant growth corresponding to the tumor, which can easily be demonstrated, or it may be due to a non-malignant stricture of the pylorus or to a short bend in this part of the alimentary canal. The tumor is farther to the right than we usually find a carcinoma of the pylorus and it might readily be a distended gall bladder or even a tumor of this organ, or it might be a movable kidney containing a small tumor. The youth of the patient might be considered an argument against the diagnosis of carcinoma of the pylorus.

Notwithstanding these facts, there can scarcely be a doubt but that this patient is suffering from the presence of a carcinoma obstructing the pylorus, because the history and the findings upon physical examination—hyperacidity, pain, hæmorrhage, dilatation, emaciation, and tumor, are very characteristic in this case.

Indications for Operation.—Judgeing from the size of the tumor and the amount of obstruction present, it is not at all likely that an operation will result in the removal of the malignant growth, or in case a removal is accomplished it is not at all probable that this will result in a radical cure. Consequently the best that can be expected from an operation is simply a certain degree of temporary relief. This relief will consist in the establishment of a free communication between the stomach and the small intestine. As a result of this the nausea and vomiting and the pain will rapidly disappear, the nutrition will improve and the patient will no longer absorb decomposition products from the stomach. Her cachexia will consequently disappear, she will gain in weight and strength and will imagine herself quite well for a time.

Sooner or later the carcinoma will have involved so great a portion of the stomach and the surrounding organs that she will succumb to the disease, but it may be a considerable time before this is to be expected.

Preparatory Treatment.—Gastric lavage will be performed night and morning for one or two days until the stomach contents no longer have an offensive odor. The morning of the day before the operation two ounces of castor oil will be introduced through the stomach tube, after the gastric lavage has been completed. In the meantime some aseptic predigested food will be given every three hours.

Should the oil not produce a very free evacuation of the bowels, the same dose will be given in the same manner every twelve hours until the desired effect has been accomplished. If the oil is not retained in the stomach free evacuation of the bowels will be accomplished if possible by means of enemata. On the morning before the operation the stomach will again be thoroughly cleansed by means of gastric lavage.

Operation.—The incision will be made as in the previous case. We find as we had expected, an extensive involvement of the

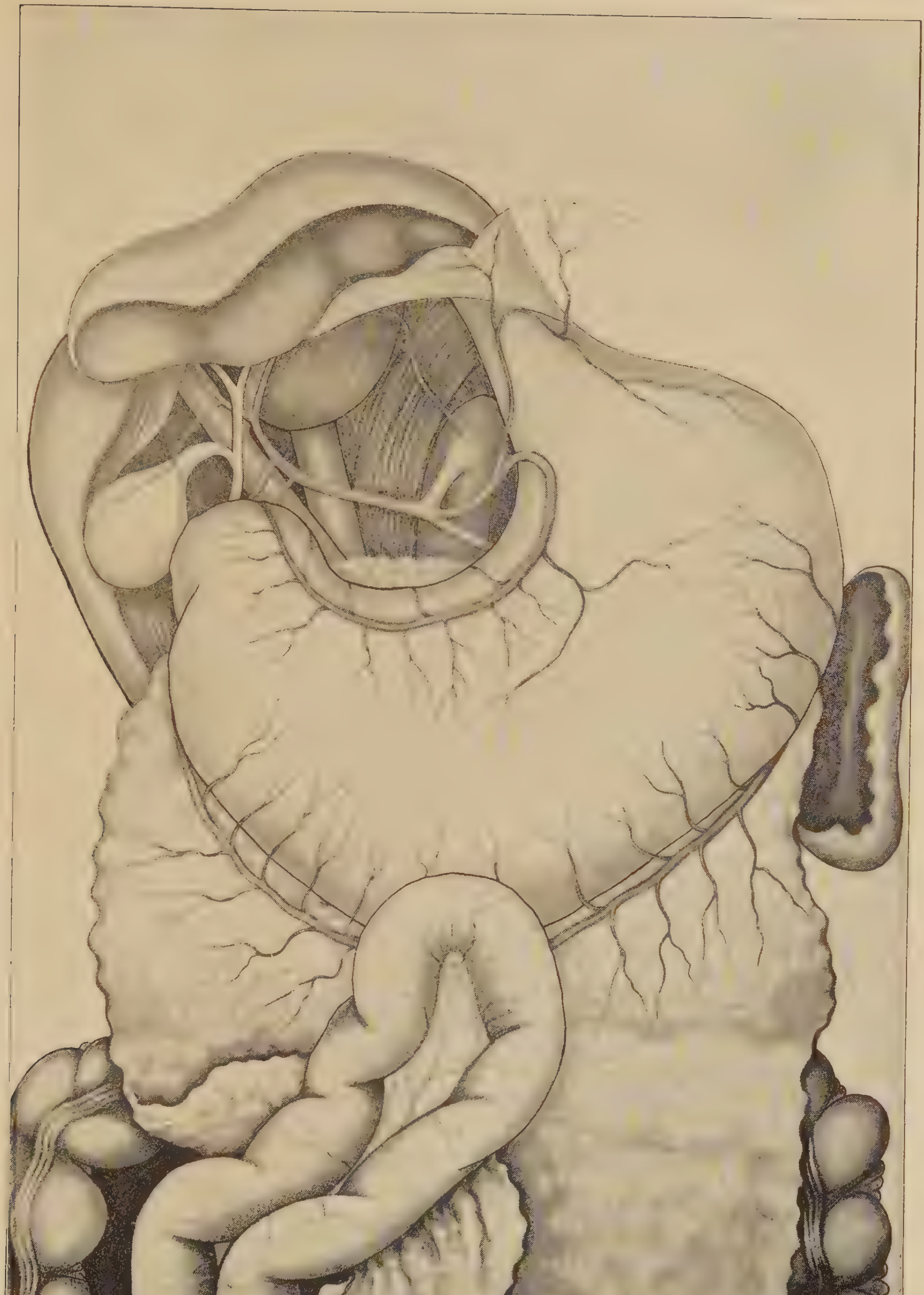


PLATE XXXVI.

Gastro-Enterostomy.

Anterior gastro-enterostomy. The jejunum being united to the stomach at its lowest point, which will prevent the regurgitation of bile, "viscious circle."

Taken from Dr. W. J. Mayo's original drawing.

entire pylorus with the tumor extending well up on the lesser curvature. The lymph glands to a considerable distance, especially behind the pylorus and along the lesser and greater curvature of the stomach, are involved. It seems plain that the complete removal of these glands, together with the tumor, is not possible, and a partial removal would only serve to excite a more rapid growth, consequently no benefit could come from an attempt at a radical operation and it would not be wise to attempt this.

The healthy portion of the stomach is greatly dilated on account of the almost complete closure of the pyloric opening. The greater curvature extends more than two inches below the umbilicus. The operation from which the greatest amount of benefit will be derived is a simple gastro-enterostomy similar to the one described in connection with the previous case.

It is again important to select the lowest point in the stomach, in order to secure a perfect drainage of this organ, and especially for the purpose of preventing the flow of bile from the duodenum into the stomach. It is also important to remain as great a distance from the diseased portion of the organ as is compatible with securing the most dependent portion; fortunately, the latter usually lies very well to the right.

In patients who are greatly reduced in strength it is well to re-enforce the Murphy button to a certain extent by the use of a cuff formed out of the omentum, as shown in Plate XXXV.

It has occasionally happened after a gastro-enterostomy in greatly reduced patients, that a sudden motion, such as would be experienced during a severe paroxysm of coughing or sneezing or vomiting, would be followed by a loosening of the anterior portion of the union between the stomach and the intestine. In these cases it is wise to enforce this union by employing the omentum, which is always well nourished and abundantly supplied with blood vessels, and will consequently make up for the deficiencies in the nutrition of the stomach wall.

In case an operation is refused by a patient in this condition, we try to secure a degree of comfort by the use of opium. We also teach her to perform gastric lavage whenever she is nauseated. In many of these patients one can secure a great degree of comfort by pursuing the following plan: Gastric lavage is performed in the morning directly before taking breakfast, which should consist as much as possible of food which can be absorbed from the stomach, therefore liquid, in order not to clog whatever slight opening there may still exist in the pylorus. Two hours later the remnants of this food are again removed by gastric lavage. The same plan is followed at noon and at night. In this manner the food is not mixed with decomposing mucus and remains of food from a previous meal, which are partly decomposed and partly digested.

After a short period of practice these patients frequently enjoy this plan, and many of these cases improve greatly in appearance, because they no longer have to absorb these products of decomposition. It is not infrequent for patients to gain in weight under this form of treatment, and there is usually a great reduction in pain in cases in which this symptom is marked.

A fear of producing hæmorrhage by the use of gastric lavage has been expressed, but I believe that this danger is greatly overestimated. Before I became familiar with the use of the Murphy button, I had occasion to treat many cases in the manner just described, and never found any difficulty from hæmorrhage.

RESECTION OF THE PYLORUS.

Had we encountered a removable tumor of the pylorus in this case, our treatment would not have varied as regards the communication between the stomach and the intestine, but this would have been preceded by the excision of the pylorus by a method which will be described presently.

There are several valid reasons for preferring a gastro-enterostomy, such as has been described, to a direct end-to-end union between the stomach and the duodenum after the excision of the pylorus: 1. It is much more easily accomplished; 2. The operation requires much less time, which is an important feature in many of these cases; 3. Surfaces completely covered with peritoneum can be united; 4. There is no tension; 5. The adjustment can be made more accurately, because in the end-to-end approximation of

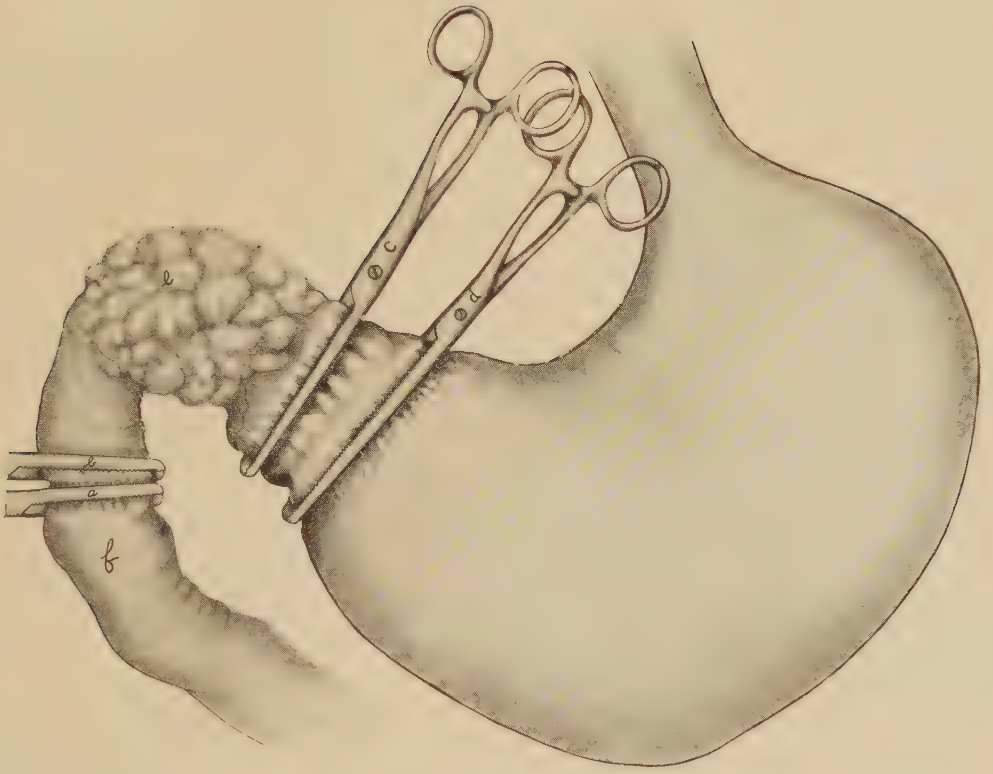


PLATE XXXVII.

EXCISION OF PYLORUS FOR CARCINOMA.

The stomach is clamped at (d), the groove thus formed being used to apply the sutures employed to close the end of the stomach. The forceps at (c) are employed to prevent leakage from the side of the pylorus containing the tumor, when the stomach is cut away at the distal side of (d) after the sutures closing the stomach have been applied. The clamps represented at (a) and (b) are used in a corresponding manner upon the duodenum, represented by the letter (f); (e) represents the tumor. The organs have been drawn without blood vessels and neighboring organs. The latter are shown in Plates XXXIV, XXXV and XXXVI.

the duodenum to the stomach there is a great difference in the lumen which varies with the amount of tissue which has to be removed from the stomach; 6. The attachment being at the most dependent portion of the stomach, the drainage is more likely to be satisfactory.

EXCISION OF THE PYLORUS.

Operation.—The diseased portion should be carried well up into the wound, so that the vessels in the greater and the lesser omentum can be ligated without difficulty. It saves time to ligate double and cut between the ligatures or to apply two pairs of artery forceps, cut between these and ligate each side at once and repeat this until the omentum has been separated from the stomach and duodenum throughout the proposed field of operation.

All parts not connected directly with the operation are now carefully tamponed away with moist aseptic gauze pads. Two pairs of strong, rather narrow-bladed pedicle clamps are now applied, one upon the stomach at a point above the tumor apparently perfectly free from disease, the other across the duodenum below the tumor at an equally safe distance. These forceps will crush the mucous membrane and all other soft tissues out of their grasp and leave only a thin layer, composed of connective tissue and blood vessels. The pair of forceps upon the duodenum is then removed and a row of sutures applied through the crushed portion, the stitches being applied sufficiently near together to completely close the lumen of the intestine at this point.

A second pair of clamp forceps similar to those which have just been removed will now be applied between the row of sutures, which has just been applied, and the tumor. The duodenum is then cut across between the sutures and these forceps. The end toward the stomach is surrounded with moist pads of aseptic gauze, while the sutured end of the duodenum is inverted into the lumen of this intestine and the end closed with a row of Lembert sutures. This much of the operation can be accomplished in a very short period of time.

If the tumor does not extend far upon the wall of the stomach the same method of closing the pyloric end of this organ can be followed and its accomplishment will occupy only a very short period of time. If much of the stomach wall is involved it is often necessary to apply one pair of forceps from above and one from below to accomplish the same end, and occasionally it is necessary to suture the stomach for a part of the distance and then separate the tumor to this point and then grasp the remaining portion with the strong clamp forceps and to repeat this until the entire end has been closed.

Before cutting away the tumor it is well to place a second pair of forceps between the row of sutures in the stomach and the tumor, in order to prevent any leakage from the side of the tumor. Of course, it is necessary to leave a sufficient amount of tissue beyond the row of sutures to prevent the slipping of the latter. The application of the row of sutures through a groove made by the forceps (Pl. XXXVIId) in the pyloric end of the stomach is greatly facilitated by having an assistant elevate the tumor by means of the forceps, which have been applied to the duodenum beyond the tumor.

After the tumor has been cut away, the row of sutures in the end of the stomach should be inverted into the stomach by the application of a row of Lembert sutures. This leaves the end of the stomach and the end of the duodenum perfectly closed. Occasionally the walls of the stomach are so much hypertrophied that it does not seem safe to apply the pressure forceps (Pl. XXXVIId) for fear of crushing an opening into the stomach. In these cases the pyloric end of the stomach can be elevated by means of the forceps which have been applied to the duodenum beyond the tumor, an incision can be made through the serous and the muscular coats down to the mucous membrane and the row of sutures may be applied through the line indicated in Pl. XXXVIId by the forcep d.

Another method for the closure of this end of the stomach consists in elevating the pyloric end of the stomach, as described above, and cutting the stomach partly across, applying a sufficient number of stitches to close this portion, then proceeding until the entire distance has been closed in this manner. This row of sutures is of course again inverted into the stomach by the application of

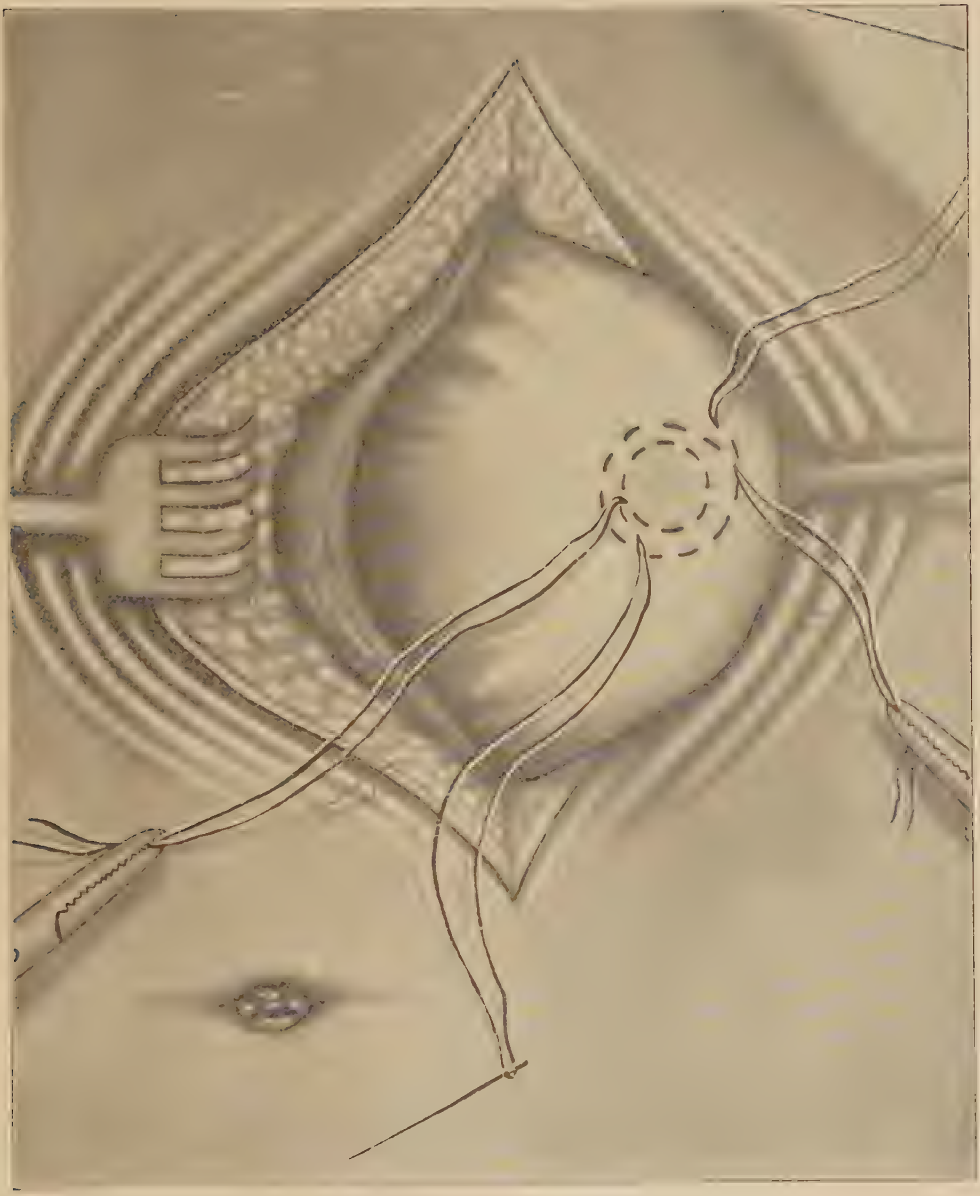


PLATE XXXVIII
GASTROSTOMY

Represents the stomach wall drawn out through the abdominal incision, with two circular purse string sutures in position

a row of Lembert sutures. If there is still some bleeding point anywhere in the field of operation this is carefully ligated and all the denuded surfaces are covered with peritoneum or omentum. Care should be taken to remove all implicated lymph glands.

The lowest point in the stomach is now found and anastomosed with the jejunum according to the method which has been described in connection with the previous case. This is followed by closure of the abdominal wall.

After Treatment.—The after-treatment is identical with that which has been described in the previous case. The operation can easily be performed in less than an hour.

GASTROSTOMY.

This operation is usually performed for the purpose of giving relief from starvation in patients suffering from obstruction of the œsophagus due to carcinoma or cicatricial contraction. In most cases the operation is consequently only of temporary benefit. In order to be satisfactory the opening must be sufficiently large to permit the introduction of food into the stomach, at the same time it must be so arranged that there can be no escape of liquid from this artificial opening, because the escape of this liquid, being mixed with gastric juice, is not only exceedingly uncomfortable to the patient, but it destroys the skin and thus gives rise to a very painful ulcer.

Clinical History.—The patient before us, a farmer sixty years of age, gives the following history: His family and personal history previous to the age of forty-five are good. At about forty-five years of age he suffered from influenza and has suffered repeatedly from slight attacks of rheumatism since. Eighteen months ago, while eating, the patient first noticed an obstruction to food in the œsophagus. It seemed to him as though the food stopped at a point near the lower end of the sternum. He experienced more and more difficulty in swallowing until the present time, when he can swallow nothing but liquids. One year ago the patient first experienced a burning sensation in the cardiac end of the stomach. Nine months ago he began to vomit after eating, which continued for several months. After taking a small portion of food the patient would vomit about a pint of slightly turbid, rather tenacious mucus. After resting for a few minutes he would be able to take his food comfortably without being further disturbed, but occasionally he would again vomit after finishing his meal. This condition persisted until two months ago, during which time he had almost a constant regurgitation of a watery fluid into the mouth, and it has been quite impossible for him to swallow any solid food. He has lost about fifty pounds in weight during the past eighteen months. There is no history of syphilis. He has a number of healthy children.

Present Condition.—Large man; emaciated; slightly cachectic; tongue clean; is very hungry and severely constipated; no enlarged lymph glands; heart, lungs and kidneys normal; abdomen scaphoid; fullness under left costal arch; œsophageal bougie locates obstruction opposite eighth costal cartilage.

Diagnosis.—The patient suffers from an obstruction of the lower portion of the œsophagus, which has been demonstrated with the bougie. The gradual onset of this obstruction, as indicated by the history, together with the age of the patient, the cachexia, the absence of traumatism, syphilis and aneurism makes the diagnosis of carcinoma positive.

Indications for Treatment.—The increase of the obstruction, the emaciation of the patient, the severe hunger, all indicate the necessity of providing for relief. At the present time the patient still has a sufficient amount of strength to bear an operation well, although his vitality has decreased rapidly during the past two months, consequently we can be reasonably certain that he will recover from the operation itself.

There are further indications from the fact that the progress of the disease has been slow and there has been no involvement of lymphatic glands at any distance from the original growth. It is consequently to be expected that the progress of the disease will be slow, especially because there will be no further irritation of the growth itself by the passage of food over its surface after the

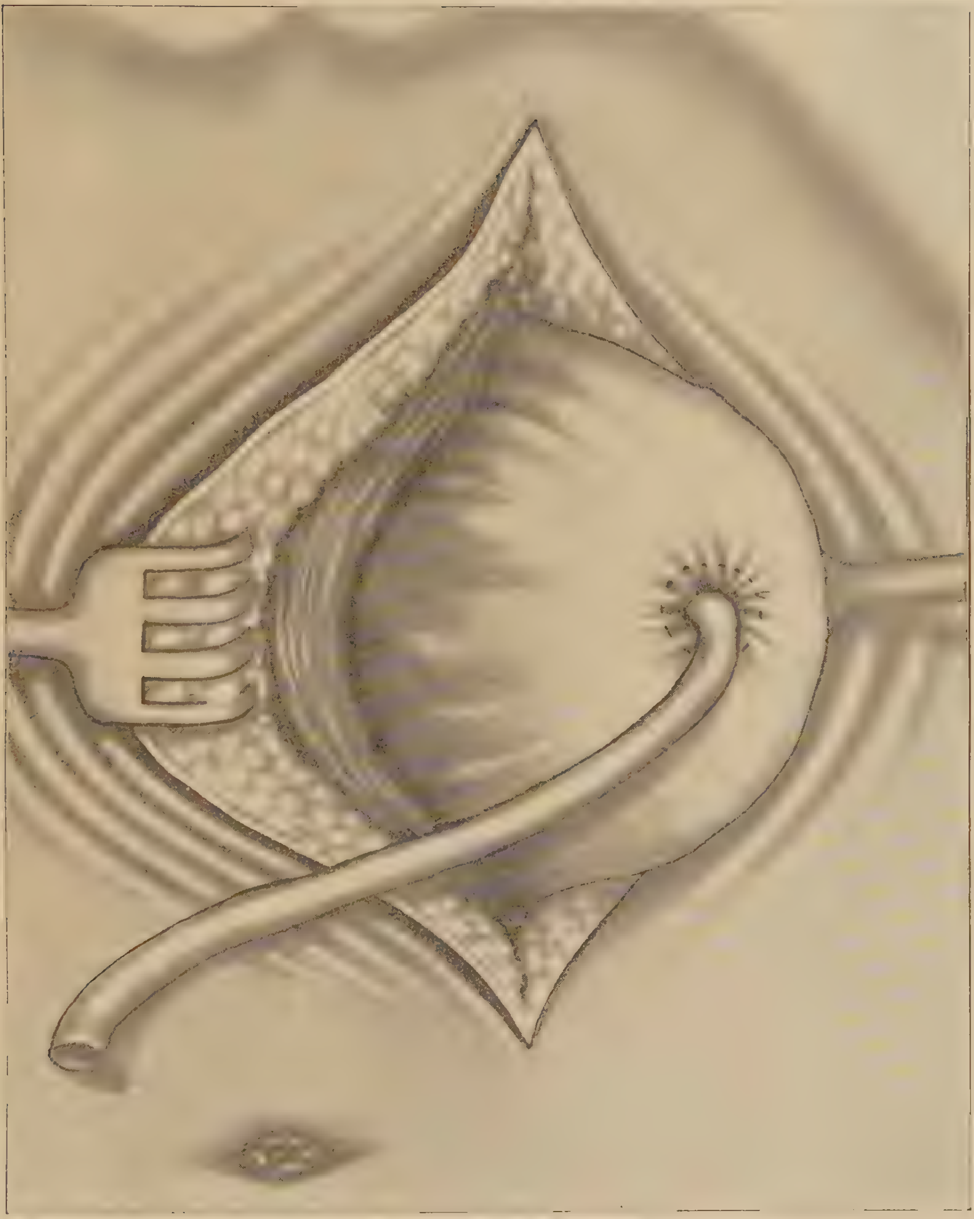


PLATE XXXIX.

GASTROSTOMY.

The same as Plate XXXVIII, with retention catheter introduced through an opening which has been made in the center of the circle formed by the purse-string sutures. The portion contained within this circle has been inverted into the cavity of the stomach and the sutures have been tied and cut short.

proposed operation has been performed. Moreover, the patient has suffered very little pain, hence it is likely that he will be very comfortable after the operation. Should this operation be postponed until the patient is no longer able to take water into his stomach, his suffering would be far more intense. The lack of food can be compensated for by the use of nutrient enemata and its absence can be made more bearable by the administration of opium or some of its derivatives, but it seems impossible in these cases to overcome the severe thirst from which the patient is sure to suffer after the obstruction becomes so complete that not even water will pass.

PREPARATORY TREATMENT.—If the obstruction is complete the operation should be performed at once after securing an evacuation of the bowels by means of a large enema. So long as there is still a slight passage through the obstruction it is well to administer some saline mineral water freely every morning for several days, in order to secure a free evacuation of the bowels, because one frequently finds large accumulations in the colon in these cases, as they have usually been severely constipated for a long time, and they will bear an operation much better if there is no decomposing substance in any part of the intestinal canal.

It is frequently possible to increase the patient's strength considerably by giving him the various concentrated predigested foods in considerable quantities at regular intervals of two or three hours for a few days. The patient usually acts better if the kind of food is changed from day to day. Ordinarily, however, they bear the operation well if it is performed rapidly and with a minimum amount of traumatism, so that it is only necessary to give the above preparatory treatment to patients who have had little or no care previous to their admission to the hospital.

The field of operation is treated as in every abdominal operation.

OPERATION.—The incision is made through the outer edge of the left rectus abdominis muscle from one and one-half to three inches in length, as shown in Plate XXXVIII. The length of the incision will depend upon the extent of contraction of the stomach and the thickness of the stomach wall. In case of a contracted stomach with a thick wall, it is necessary to make the abdominal incision longer than in case of a large, thin-walled stomach, in order to secure a sufficient amount of space to perform the necessary manipulations without causing too much traumatism.

The anterior surface of the stomach is now drawn into the wound and two purse-string sutures of fine silk are applied, as shown in Plate XXXVIII, the circle described by the first suture being about three-fourths of an inch in diameter. In each case a little more than a full circle is described, in order to provide against a possible defect. These stitches grasp all the layers of the stomach down to the mucous membrane, including the submucous connective tissue. The space within the inner circle is then punctured with a trocar, and a tube from one-fourth to one-half inch in diameter made out of rather stiff pure rubber, fashioned after the pattern of a Jacob's retention catheter, is inserted into this opening. This will produce an infolding of the stomach wall, as shown in Plate XXXIX, which is still further exaggerated when the purse-string sutures are tied. The enlargement at the end of the stomach tube prevents this from slipping out of the opening again, and the close application of the serous surface of the stomach to the surface of the tube prevents any leakage. This condition is still further enforced by the application of several rows of Lembert sutures to each side of the tube, as shown in Plate XL. In a thin-walled stomach it may be desirable to apply four or five rows of these interrupted sutures, while in the thick-walled stomach two or three rows outside of the purse-string sutures will suffice. All of the stiches we have used consist of fine silk, but this seems to be of no importance. The end of the stomach tube should be closed with a cork, or clamped with some convenient contrivance, so that no stomach contents may be expelled during the operation. The important condition to be obtained is a provision against leakage, which the method I have just described has always accomplished in a most satisfactory manner.

We must next secure an attachment of the stomach to the abdominal wall. This is accomplished by first inserting silkworm gut sutures through all of the layers of the abdominal wall, then all of the layers of the stomach wall down to the mucous membrane,

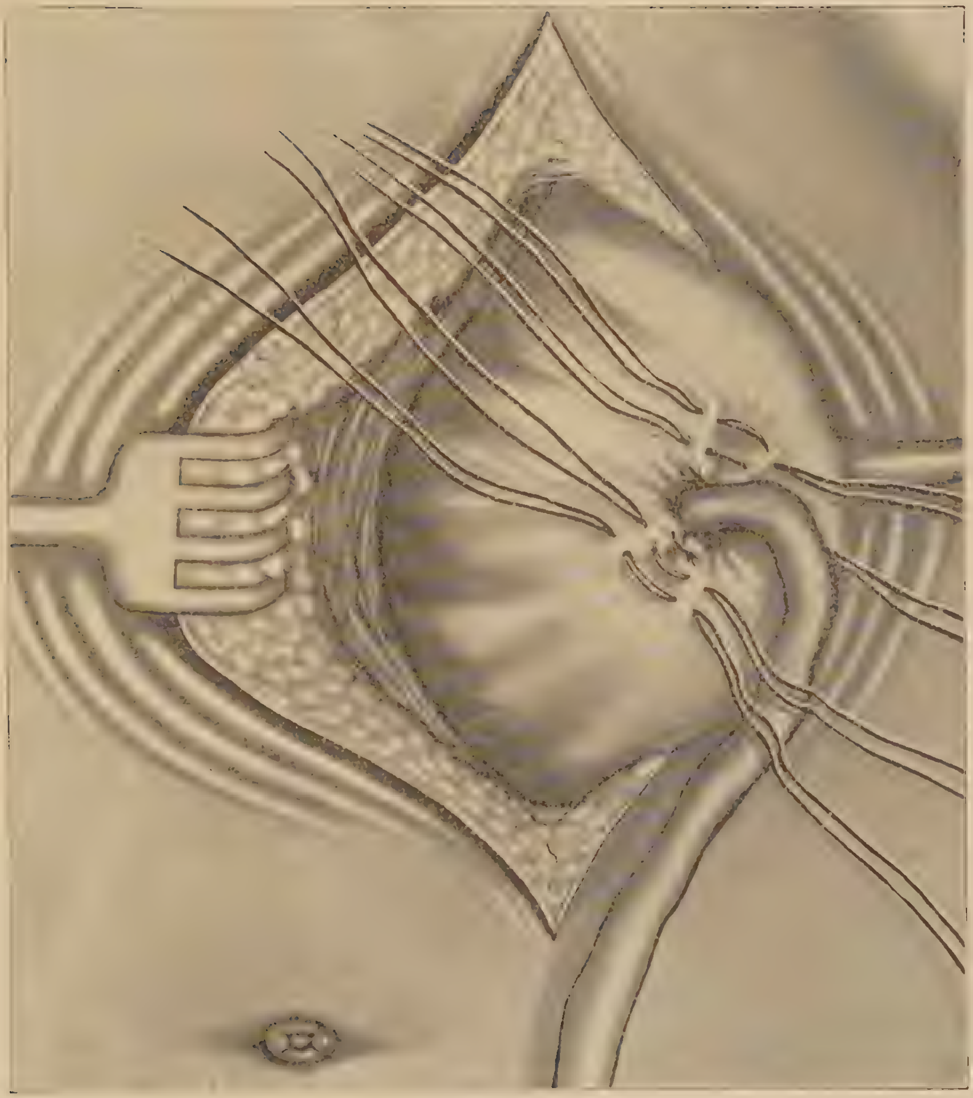


PLATE XL.
GASTROSTOMY.
Lembert sutures applied to either side of the catheter in order to invert the wall of the stomach still further, in order to prevent leakage along the retention catheter.

then out through all of the layers of the abdominal wall on the opposite side, as shown in Plate XLI. A second suture is applied in a similar manner on the opposite side of the feeding tube. Then the stomach wall is sutured to the peritoneum and transversalis fascia by a number of interrupted sutures. The abdominal wound is then closed in the usual way, the feeding tube being permitted to pass out through the middle of the wound. An ordinary dressing is applied and the abdominal wall is supported by means of a broad, rubber, adhesive strap above and below the feeding tube. A liberal pad of cotton, held in position by an abdominal binder, completes the dressing. The feeding tube is permitted to pass through this binder so that the patient may be fed without disturbing the dressing.

In some of these patients, who have become much reduced in strength the adhesions formed between the stomach and the abdominal wall are very frail unless increased by means of some irritation. I have found the use of iodoform gauze very satisfactory if applied in the following manner: A piece of iodoform gauze is folded around the feeding tube, as shown in Plate XLII, and stitched to the stomach with a number of interrupted catgut sutures. All of the other steps of the operation are carried out as described above, so that this is simply an additional safeguard. After about ten days the catgut will be absorbed and then the gauze may be withdrawn. It will usually be found quite strongly adherent and the adhesions between the stomach and the abdominal wall will have become exceedingly firm by this time. The entire operation can be performed without the slightest haste in so short a time that there is no cause for shock.

After Treatment.—If the obstruction has been complete, so that the patient suffered severely from thirst before the operation, half a pint of warm normal salt solution should be poured into the stomach through the feeding tube at the close of the operation, and this should be repeated every half-hour until the patient is satisfied. If he has still been able to quench his thirst before the operation he may be allowed to drink water naturally after the procedure if this causes no distress or annoyance; otherwise it is to be given through the feeding tube entirely. After a time the absence of irritation may cause a disappearance of the complete obstruction and then the patient will again be able to take liquids by mouth. In the meantime, he should be fed regularly every three hours with peptonized milk, raw egg, the juice expressed from roast beef or rare broiled steak, rich broths, soups and mush. The food can be poured into the stomach through a funnel, or an ordinary glass syringe may be attached to the feeding tube and this will serve as a funnel.

Later the patient may chew any kind of food very fine and thus mix it with saliva. He can then inject this through the feeding tube into the stomach. These patients can thus improve their digestion, especially of starchy food, and they can continue enjoying their meals in this way.

Almost invariably these patients gain rapidly in weight and strength, because the enforced rest of the stomach and intestines has usually placed these organs in a condition in which they can thoroughly digest an abundance of food. I have repeatedly observed these sufferers gain sufficiently in strength in a few weeks to enable them to do hard manual labor, which they continued to do until the carcinoma had implicated some other important organ, either by invasion or by the formation of metastases.

It is, of course, necessary to explain to the friends of the patient that this operation cannot result in a cure of the disease, but that it can simply give temporary relief. This relief, however, is so great, and the risk in obtaining it is so slight, that it is an operation which can be very strongly recommended. Aside from the distress due to hunger, and especially to thirst, patients afflicted with obstruction of the œsophagus suffer pain but slightly, consequently the relief given by this operation is relatively very complete.

GASTROSTOMY FOR THE RELIEF OF CICATRICIAL STRICTURE OF THE ŒSOPHAGUS.

In cases of stenosis of the œsophagus, due to cicatricial contraction following ulcer, and which cannot be dilated with bougies from above, it may become necessary to make a gastrostomy, in order to

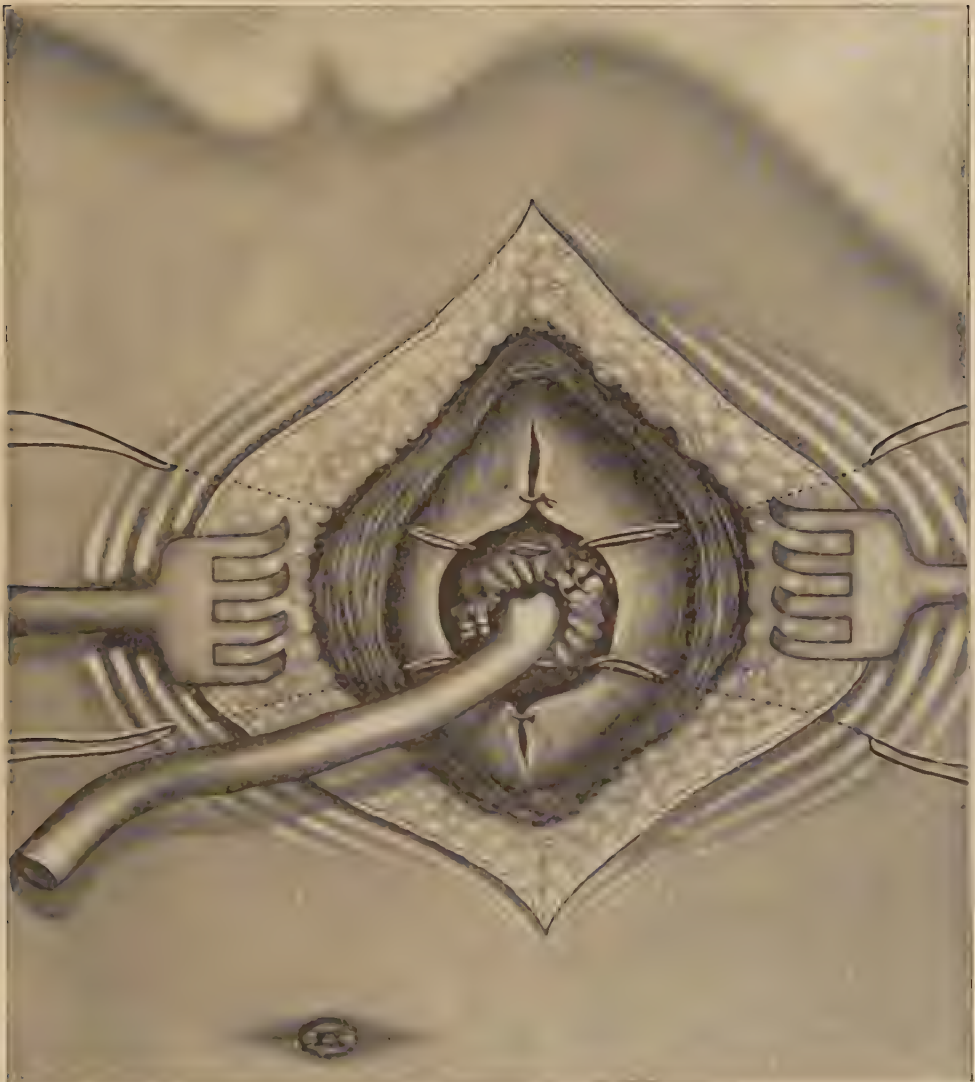


PLATE XLI

GASTROSTOMY.

Represents the manner of attaching the stomach to the abdominal wall by means of cat-gut sutures, uniting the stomach to the parietal peritoneum and transversalis fascia. Two deep silkworm gut sutures, which extend through the entire abdominal wall, grasp the wall of the stomach in order to act as stay sutures.

upon the original silk cord, which is not a safe practice, because in case this cord should break it might be difficult to replace it, while there is no danger of its breaking in simply carrying through another cord.

The rubber tube will stretch out into a thin body when drawn through a tight stricture, but when relaxed, it will serve as a powerful dilator. The size of the rubber tube may be increased, or any desired number of rubber tubes may be drawn through the stricture at the same time, as the caliber of the latter increases, as shown in Plate XLIV. In this case, the rubber tubes were drawn back and forth each day, the number and size of the tubes being gradually increased. This, however, requires a large opening in the stomach, which is not necessary if a silk cord is used to draw the rubber tubes down into the stomach, but not out through the wound in the stomach.

Later on, a Barnes dilator, in a collapsed condition, may be drawn into the stricture, as shown in Plate XLV. In this case the dilator was drawn into the stricture from below, which would not be possible with a similar gastrostomy, but it could be drawn down from above with no more difficulty. The fact that the dilator is engaged in the stricture can be recognized by the difficulty one experiences in drawing it into the narrow opening, and the shoulders upon the bag have a tendency to prevent its slipping beyond the stricture. Should this, however, occur it can readily be recognized, because then there is no further obstruction to the progress of the dilator.

When once in place the Barnes dilator is inflated with air by means of a rubber bulb. The patient's own feeling must serve as a guide to the degree of dilatation it is safe to make use of at any given time and the length of time it is wise to leave the bag distended.

In case simple dilatation, either by the use of rubber or the Barnes dilators, does not seem to expand the stricture rapidly enough, the edges of the stricture may be rendered tense, either by drawing into the stricture as many rubber tubes as possible or by inflating the rubber bag, as shown in Plate XLVI, and then using the silk cord after the fashion of a chain saw, and thus cutting

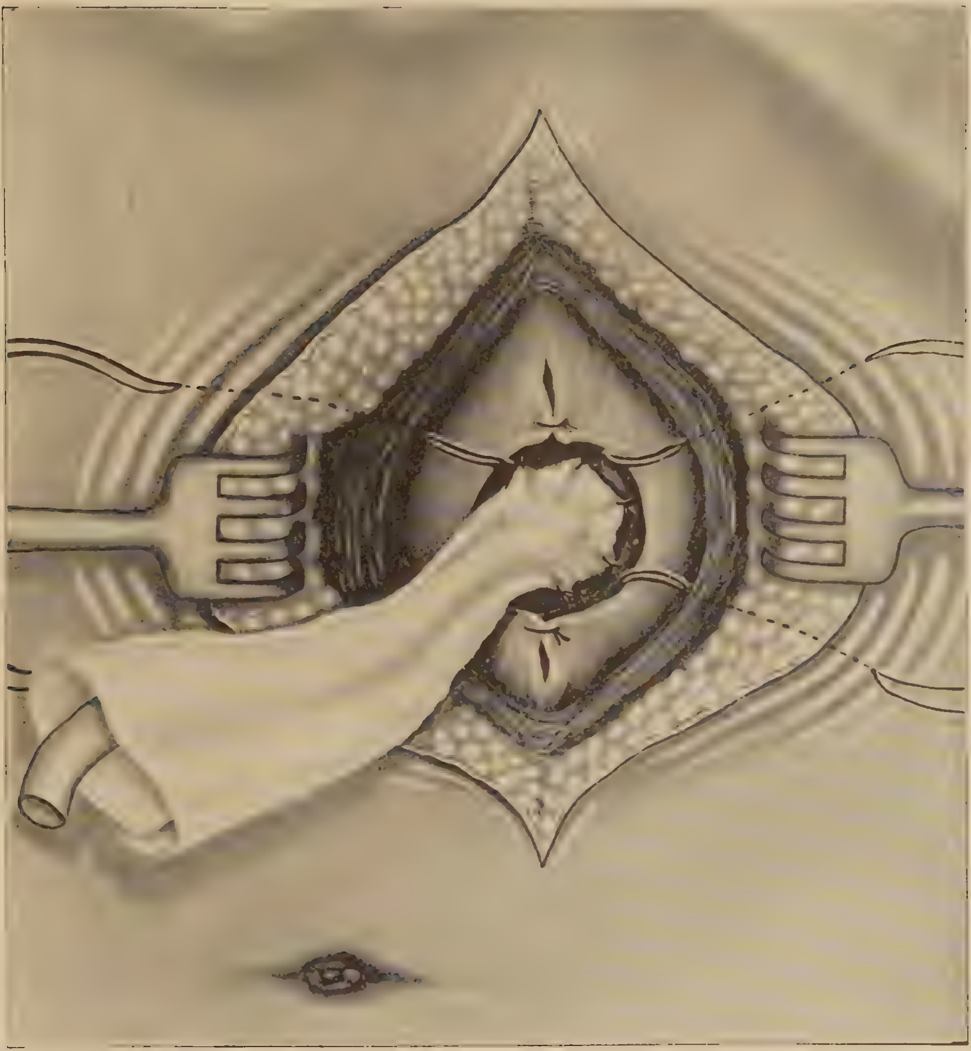


PLATE XLII.
GASTROSTOMY.

The same as Plate XLI with the addition of a piece of iodoform gauze folded about the retention catheter and attached to the wall of the stomach by interrupted cat-gut sutures, in order to make the adhesion to the abdominal wall more secure.

the edge of the stricture. After a considerable degree of dilatation has been obtained it is well to attempt the passage of œsophageal bougies from above, because these can be passed by the patient every day, which will save much labor on the part of the surgeon; but the surgeon should personally superintend this performance at least once a week, because the patient often imagines that he has succeeded in passing a bougie when he has but barely touched the stricture.

In these instances a bougie should be passed at least once a month during the remainder of the patient's life, in order to prevent a late contracture, which sometimes comes on so gradually that the patient does not recognize it until advanced so far that it is difficult to dilate it again with bougies.

After removing the feeding tube in these cases in which an adequate passage through the œsophageal stricture has been established by dilatation, the opening in the stomach will close spontaneously. Of course, in cases of stricture due to carcinoma the feeding tube must be left in place continuously, unless the patient prefers to insert a tube at each feeding and to withdraw it after each meal.

The most convenient instrument for this purpose is a silver speculum with an obdurator, such as is in use for examining the female bladder. This is introduced with the obdurator in place, which is then withdrawn and a rubber tube attached through which the food is conducted into the speculum, and through this into the stomach. The speculum must be carefully oiled and introduced with great care to avoid irritating the canal. Most patients, however, are contented with a rubber feeding tube in place, and this does not interfere with their comfort in any way; it is therefore scarcely necessary to use the more complicated plan of removing the tube after each meal and reintroducing it before each meal.

EXCISION OF GASTRIC ULCER.

It has seemed at times wise to remove a gastric ulcer radically by excising it entire and uniting the edges of the wound in the stomach. This has been done especially because long known that gastric ulcers are a predisposing cause to the development of carcinoma. Usually these ulcers do not persist unless there is an obstruction to the passage of the food through the pylorus, and if this condition exists the excision of an ulcer would hardly result in a permanent cure. Moreover, the establishment of free drainage of the stomach by means of a gastro-enterostomy would result in the healing of such an ulcer. However, there is a class of ulcers which stand on the border line of malignant growths, and in this class an excision of the ulcer and surrounding tissues is certainly indicated. This can be done most safely by lifting up the stomach and making an incision around the ulcer, first through the serous and muscular coats, then grasping all of the vessels with hæmostatic forceps and ligating them with fine catgut, then lifting the wall of the stomach so as to have the wound extend at right angles with the long axis of the stomach. The mucous membrane may now be sutured without first cutting it, or it may be cut and then sutured with a continuous catgut or silk suture, the first row grasping only the muscular and mucous layers. Over this a continuous Lembert suture is applied. This suture grasps all of the layers down to the mucous membrane, but not through it. By applying this row of sutures transversely with the axis of the stomach one avoids the tendency of narrowing the lumen of the pylorus in case the ulcer is near the pyloric end.

The excision of an ulcer should not prevent the surgeon from making a gastro-enterostomy if this is otherwise indicated, but a portion of the stomach must be selected sufficiently distant from the location of the ulcer to insure satisfactory healing. Of course, the same precautions should be taken in making gastro-enterostomies in these cases as in all others.

In cases in which a chronic ulcer of the stomach co-exists with a stenosis of the pylorus, sufficiently small to indicate a gastro-enterostomy, it is doubtful whether an excision of the ulcer is ever indicated, because the gastro-enterostomy will be followed by a perfect drainage of the stomach, and this by the permanent healing of the gastric ulcer.

In case of perforation of a gastric ulcer, the abdomen should be opened at once and the operation just described performed, after

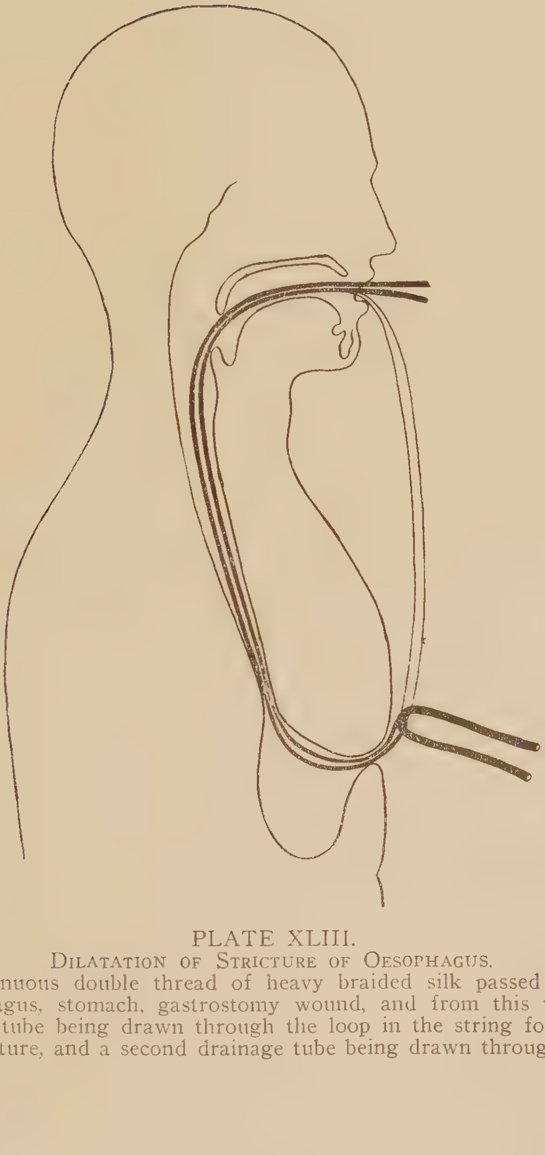


PLATE XLIII.

Dilatation of Stricture of Oesophagus.

Shows continuous double thread of heavy braided silk passed through mouth, pharynx, œsophagus, stomach, gastrostomy wound, and from this to the mouth, a rubber drainage tube being drawn through the loop in the string for the purpose of dilating the stricture, and a second drainage tube being drawn through the loop made by the first.

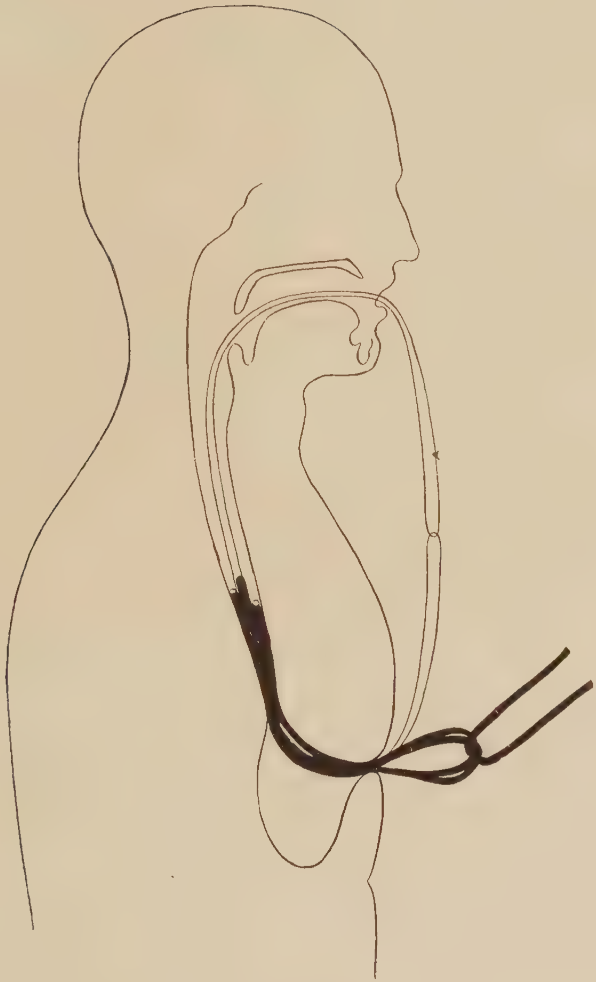


PLATE XLIV.

Dilatation of Stricture of Oesophagus.

The same as Plate XLIII, a larger double rubber drainage tube having been drawn through the loop in the first and left in the stricture temporarily for the purpose of dilating the latter.

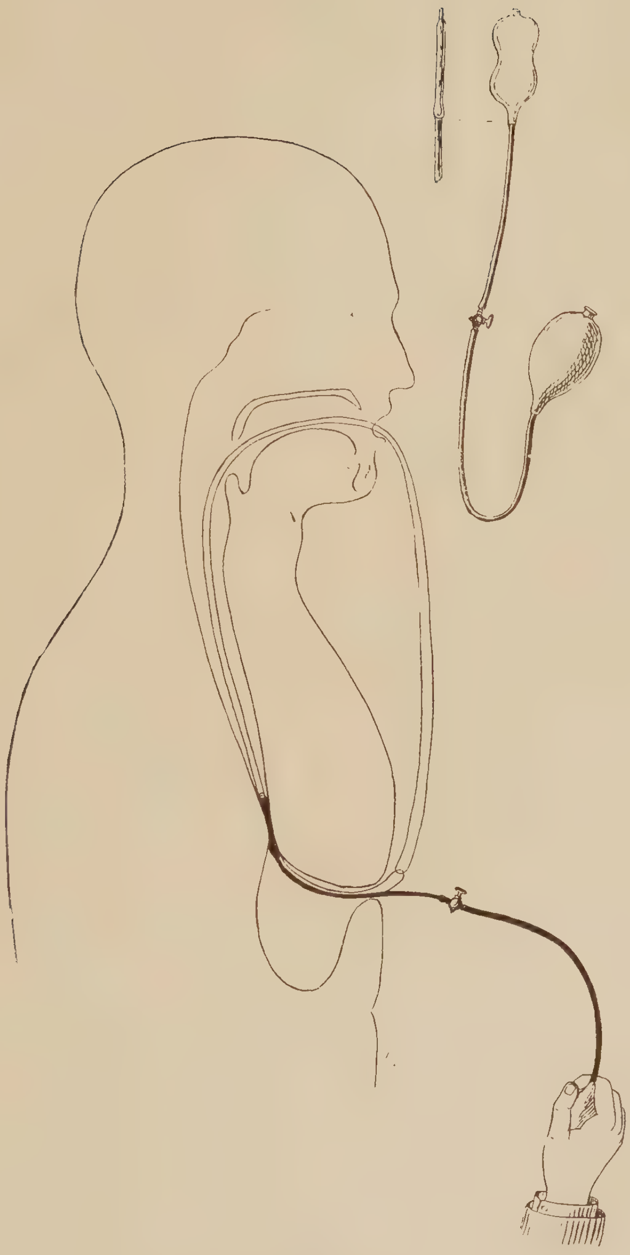


PLATE XLV.

Dilatation of Stricture of Oesophagus.

Barnes' dilator introduced after a partial dilatation has been accomplished by the methods illustrated in Figs. XLIII and XLIV. The stop-cock enables the surgeon to distend the bag and to keep it distended for any desired time while engaged in the stricture.

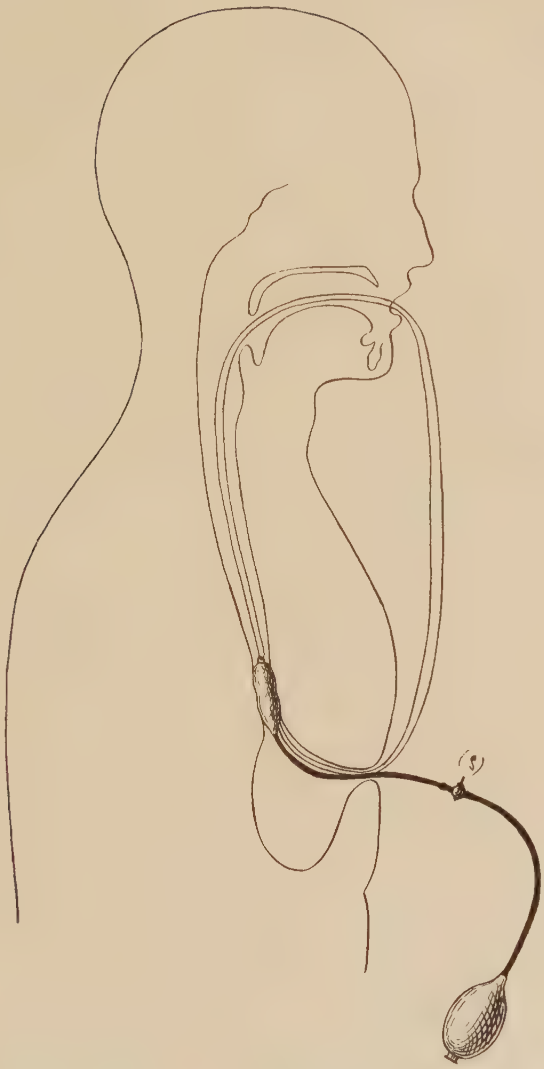


PLATE XLVI.

Dilatation of Stricture of Oesophagus.

Barnes' uterine dilator in position; (s) shows the stop-cock, which maintains a constant degree of dilatation.

the abdominal cavity has been carefully sponged with moist aseptic gauze pads to remove all of the blood and stomach contents which have been expelled into this cavity. The danger to the patient in these cases does not, ordinarily, come from the operation, but from the loss of blood which has taken place before the operation was begun, or from the infection of the peritoneal cavity, due to the soiling with contents of the stomach.

The stomach walls in the vicinity of an ulcer are often very brittle, so that the stitches do not hold well. Indeed, they may cut through the walls regularly and make suturing impossible. It is usually better to cut away a considerable amount of stomach wall surrounding the ulcer than to remain too close to the edges thereof, because the loss of a small amount of stomach wall is of very little importance compared to the risk of placing sutures in unsafe tissue.

It is likely that many gastric ulcers approach the point of perforation, but escape this condition because of adhesions which form at this point between the omentum or the parietal peritoneum and the stomach. That this condition occurs frequently is shown by the considerable number of cases in which we find the stomach adherent to the anterior abdominal wall or to the omentum, as well as by the number of abscesses of the abdominal wall which communicate with the stomach. These facts are significant in a clinical way, because they indicate that a patient may recover spontaneously from a perforation of the stomach, if the omentum or the parietal peritoneum are in proper position to form efficient adhesions.

If the patient does not come under the surgeon's care for a number of hours after the perforation has taken place, it is doubtful whether it is ever wise to perform an operation unless a circumscribed abscess has developed, for the disturbance of any adhesions which may have formed might readily change a circumscribed into a diffuse infection. It would seem wiser in cases coming under observation too late for an early operation to secure rest by the use of morphine, given hypodermically, to give neither food nor water by mouth, and to substitute for this the use of nutrient enemata. In cases seen within a few hours after the perforation has taken place, it seems wise to perform an abdominal section at once.

It seems likely, however, that this condition will in the future be treated by prophylactic measures, that cases of gastric ulcer will be treated surgically before they have had an opportunity to perforate. This treatment would consist in securing good drainage for the stomach by performing a gastro-enterostomy, or by excision of the ulcer, as has been indicated above, in case there is no pyloric obstruction.

Surgery of the Intestines.

GENERAL CONSIDERATIONS.

The greatest number of operations upon the intestines are performed for the relief of mechanical obstruction. This may be due to strangulation, as in strangulated hernia, or constriction due to a cicatricial band or an adherent Meckel's diverticulum, or an adherent appendix or a volvulus. Again it may be for the relief of obstruction due to a foreign body in the alimentary canal, such as a gall stone or an enterolith. It may also be due to a malignant growth occluding the lumen of the intestine or to an intussusception.

There are a few general principles which should be borne in mind in all surgical work upon the intestine, viz.

1. The circulation should be as perfect as possible at the point of operation. There is always great danger of interfering with the blood supply when sutures or ligatures are applied in the vicinity of the omentum or the mesentery.

2. Care should be taken never to apply stitches or ligatures to the omentum near its attachment to the colon, because this is frequently followed by gangrene.

3. In all operations it is important to apply the sutures so that the two layers of the mesentery are held together, because the space between these layers is not covered with peritoneum and is consequently deprived of nutrition, if this precaution be not taken. When an end-to-end anastomosis is made in the small intestine this danger can be still further guarded against by placing the ends so that the mesentery does not come directly in apposition in the two segments, twisting one segment a few degrees to the right and the

other a few degrees to the left, so that there is a distance of about one-eighth of the circumference of the intestine between the mesenteric attachments of the two segments.

4. The same principle applies to the choice of location and form of the anastomosis. It is always safer to make an anastomosis where it is possible to unite surfaces which are covered with peritoneum, hence in many instances a side-to-side, or an end-to-side anastomosis is to be preferred to an end-to-end junction.

5. Tension should always be avoided.

6. The omentum can be utilized to enforce an anastomosis by supplying nutrition from its rich circulation.

EXCISION OF THE CÆCUM.

HISTORY.—The patient under consideration is a farmer fifty-six years of age who gives the following history: Family and previous history negative. Has enjoyed good health and has been able to work hard until a few months ago. The only discomfort he has experienced has been from chronic constipation which has existed for many years, but which has alternated during the past year with acute attacks of dysentery which have lasted but a day or two at a time. He has suffered from indigestion and from gaseous distention of the abdomen. The latter condition has become worse constantly during the past few months. In the meantime the patient has lost forty pounds in weight, his appetite having constantly become more and more impaired, and during the past few weeks he has frequently experienced a feeling of nausea.

PRESENT CONDITION.—Somewhat emaciated, slightly cachectic man, skin dry, very slightly jaundiced, tongue coated, appetite poor, severely constipated, heart, lungs and kidneys normal, temperature slightly sub-normal. Abdomen thin-walled, soft, slightly distended, peristalsis of small intestines can be seen on surface of the abdomen. At a point half-way between the end of the twelfth rib and the anterior superior spine of the ilium a hard, oval, slightly lobulated mass apparently four inches in length and two inches in diameter can be felt through the abdominal wall. It is slightly movable and not especially painful upon manipulation. It seems to be attached posteriorly. Upon inflation of the colon by means of a bicycle pump attached to a rectal tube the tumor is not displaced and the gas does not distend the colon in front of it. The distention seems to extend to a point directly above the beginning of the tumor.

DIAGNOSIS.—A careful review of this history must direct our attention to the existence of partial obstruction of the alimentary canal, which is increasing in character and has of late become almost complete, as indicated by the frequent feeling of nausea.

The location of the tumor corresponds to the cæcum or the ascending colon. Its sessile nature would indicate the same organ. The fact that it is not disturbed by the inflation of the colon would eliminate the kidney and the gall bladder. The fact that continued treatment with cathartics does not affect the size or form of this tumor, would eliminate fæcal impaction. The age of the patient and the cachexia would point toward malignancy. We will consequently make a diagnosis of carcinoma of the cæcum or the ascending colon, or both.

INDICATIONS FOR TREATMENT.—There has been a constant increase in the obstruction, hence it is to be expected that a complete interference must occur soon. In order to avoid this some radical measure must be instituted. Moreover, this should be undertaken before the patient's strength has declined still more. We shall consequently advise an operation as soon as the patient has received the necessary preparation.

Complete intestinal obstruction might occur in this case at any time by the occlusion of the slight remaining opening in this intestine with some small mass of undigested food. I have seen in these cases a small piece of meat fiber or an orange seed, and in a number of cases an enterolith, cause a complete obstruction. In case this occurs the condition becomes exceedingly grave at once because the same symptoms will arise which characterize acute mechanical obstruction of the intestine, namely, pain, sudden gaseous distention of the abdomen, nausea, vomiting and shock. Patients quite advanced in age and greatly reduced by long continued disease do not bear this condition well. The question consequently arises as to the advisability of an immediate operation. In case the patient comes under treatment at once the immediate operation is undoubtedly indicated because the intestines are still in a good condition and the patient has not lost much in strength. It has, however, been my experience that these patients have become accustomed to the use of strong cathartics and that consequently they are likely to employ such means for several days before consulting a physician, changing from one to the other drug until they are completely exhausted. In such examples I have found that an immediate operation is usually followed by the speedy death of the patient, because his strength has been greatly impaired and great pressure has been brought to bear upon the badly-nourished intestinal walls above the point of obstruction, because of the constant use of strong cathartics. The intestines are distended, making an operation extremely tedious. This distention is accompanied with a greater permeability of the walls to the passage of micro-organisms, hence an infection is favored in this manner. It usually becomes necessary to open the intestine and to permit its contents to escape before the bowels can be replaced in the abdominal cavity. This accounts for the extremely high death rate in cases operated upon under these conditions.

For a number of years I have consequently followed another plan and have found it far safer for the patient. Cases brought to the hospital in an apparently hopeless condition have improved from day to day and were presently carried to a point at which it was possible to perform the necessary operation as safely as it is in the instance before us. Of course there are cases which are moribund at the time of admission to the hospital and these will die, usually within a few hours after admission, no matter whether or not they are operated.

The treatment that has been followed by the greatest percentage of recoveries in my experience has consisted in reducing the pressure, as much as possible, above the point of constriction. This can be accomplished best by performing gastric lavage several times in succession at intervals of a few hours under cocain anæsthesia of the pharynx. There is usually a regurgitation of decomposing material into the stomach, which will be removed by the gastric lavage. In this manner the stomach, and the intestine above the obstruction, soon become emptied of decomposing material and gas. The distention disappears gradually, the intestinal walls seem to regain their power of contraction and the absorption of products of decomposition ceases and the patient's condition improves practically in all cases in which the intestines still contain a sufficient amount of tone to force their contents back into the stomach by return peristalsis.

In the meantime the patient is supported by the use of nutrient enemata, one ounce of one of the liquid predigested foods in the market being dissolved in three ounces of normal salt solution and administered through a soft catheter inserted into the rectum a distance of about two inches. This should be repeated once in four hours. If the patient suffers from thirst half a pint of normal salt solution may be given as an enema in the same manner every hour until the thirst has subsided. It is important not to introduce the catheter a greater distance than about two inches because otherwise one frequently observes severe irritation.

This treatment can usually be continued with benefit and with safety for a number of weeks. In many cases the absence of irritation and pressure from above will result in the passage of gas and liquid fæces through the stricture, because there is always a certain amount of œdema which subsides when the irritation has disappeared.

It is best not to give any food by mouth in these patients, after the obstruction has once been complete, until the hindrance has been removed. Should it seem necessary to postpone the operation for a time it is best to continue the use of the nutrient enemata and to give only such nourishment by mouth as will be completely absorbed from the stomach.

After this condition has been attained in cases of complete intestinal obstruction, due to the presence of carcinoma in the colon, the treatment will be the same as in cases like the one before us in which the obstruction is not complete. In cases in which the stricture remains impermeable, the operation for the relief of the obstruction will have to be carried out at a time which seems favorable in the judgment of the surgeon who has the case under observation. In these cases there can, of course, be no further preparatory treatment such as is indicated in the others.

PREPARATORY TREATMENT.—In all operations upon the alimentary canal it is well first to remove so far as possible all of the contents by the administration of cathartics and large enemata and then keeping the patient on sterilized food entirely until the time of the operation. It is well to repeat the cathartics once or twice, if the patient's condition warrants it, in order to remove as much as possible all infectious material from the alimentary canal. Two ounces of castor oil, given in the foam of beer, ale or malt extract, is usually most effective and gives rise to the least amount of irritation. The field of operation is prepared in the usual manner.

OPERATION.—In this patient the tumor can be located definitely, consequently the incision will be made in a position facilitating its removal. It is not possible to determine the exact length of incision that may be required for the removal of this tumor, hence we must choose a location for the incision which will permit its enlargement. We will choose the outer edge of the right rectus abdominis muscle, as shown in Plate XVI c. This can be lengthened indefinitely if it should seem desirable during the process of the operation.

We find a tumor in the cæcum and ascending colon beginning a little above the entrance of the ileum into the cæcum. The tumor is about two and one-half inches in length and involves the entire circumference of the intestine. It is exceedingly hard, but has not perforated the wall of the bowel at any point apparently. It seems as though the entire growth were still confined to the intestine and consequently its removal may result in a permanent cure. At any rate it is certainly worth the effort to secure such a result.

It will be necessary to remove the entire ascending colon together with the cæcum. We must consequently plan to secure a union between the ileum and the transverse colon. We will first tear an opening through the mesentery of the ileum an inch from its entrance into the cæcum. A strong, long-jawed hæmostatic clamp is applied to the ileum on the side toward the cæcum. A

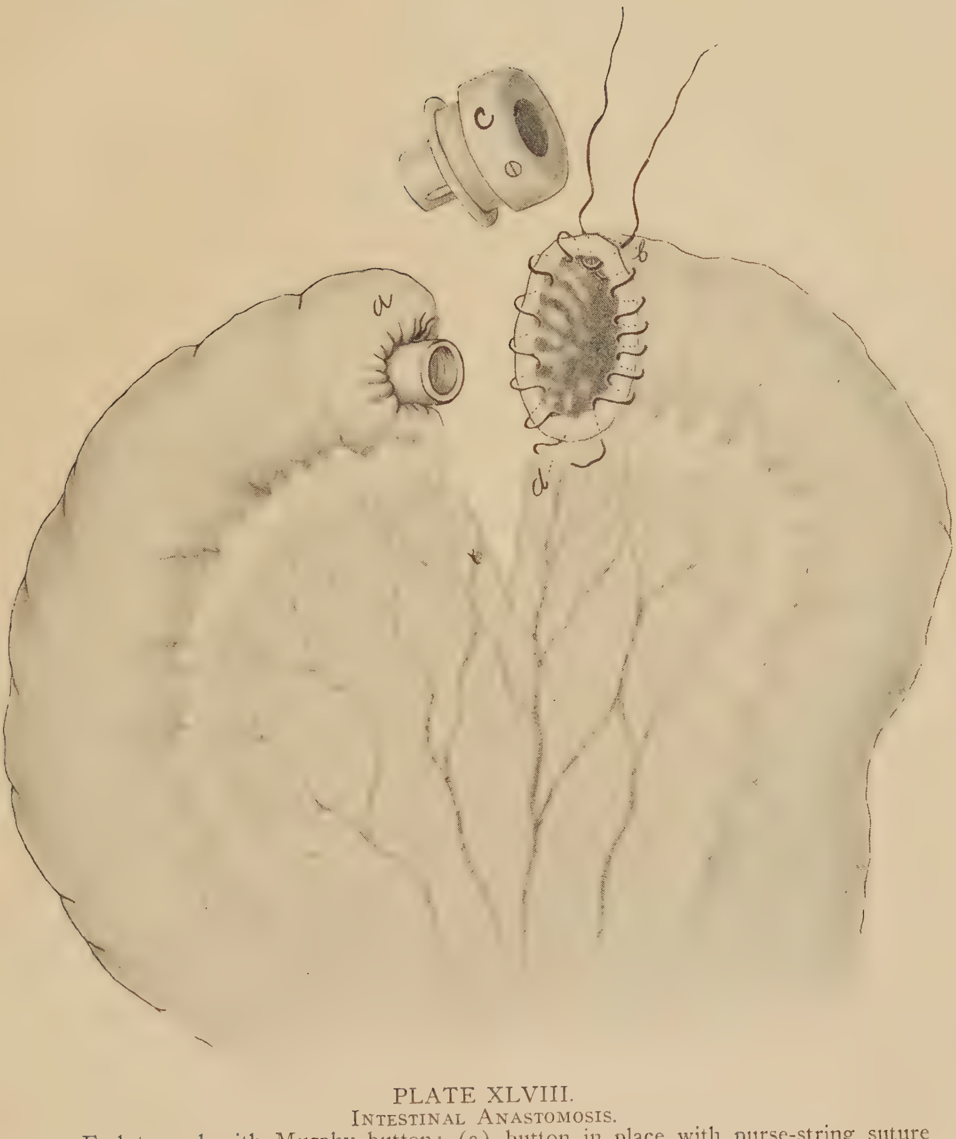


PLATE XLVIII.

INTESTINAL ANASTOMOSIS.

End to end with Murphy button; (a) button in place with purse-string suture tied; (b) end of intestine with suture in place, showing manner of including mesentery at (d); a mesenteric vessel is represented as tied at a point a little below and to the left of (d); (c) represents the remaining half of the button to be introduced into the segment (b).

circular purse-string suture is then applied, either before or after severing the intestine. If the intestine is severed before the suture is applied I prefer to apply the latter after the method illustrated in Plate XLVIII, because this insures the holding together of the two layers of the mesentery as well as inclusion in the bite of the Murphy button of a uniform amount of each layer of the intestinal wall.

Before severing the intestine as assistant should grasp it, at a distance of about six inches from the cæcum, between his thumb and finger to prevent the leakage of intestinal contents while the button is put in place. The same result may be accomplished by perforating the mesentery between the large vessels which can readily be recognized, and tying a strand of aseptic gauze around the intestine just sufficiently firm to prevent leakage. It is well to draw a snugly fitting pledget of moist aseptic cotton through the button to prevent leakage after it has been tied into the end of the intestine and before it has been united with its fellow. The smaller portion of the button should be employed in this end of the intestine. The button is inserted and the purse-string suture is tied snugly about the projecting central tube of the button and the ends are cut short. Now this end is laid aside and covered with a warm moist pad of aseptic gauze.

The cæcum is now lifted out of the abdominal wound by means of the large clamp forceps upon the small portion of ileum which has remained attached to the cæcum. The peritoneum together with its blood vessels is now grasped in hæmostatic forceps, both to the inner and outer side of the cæcum. Then the portion between is cut away with scissors. In this way the cæcum and the ascending colon can be freed rapidly.

As the operation approaches toward the hepatic flexure of the colon it is important to proceed cautiously for fear of clamping the duodenum together with the peritoneum by which the ascending colon is attached. In this manner the hæmorrhage can be controlled perfectly and the excision made rapidly. Having reached the hepatic flexure of the colon we are at least three inches beyond the tumor. We now apply two pairs of heavy, long-jawed hæmostatic clamps transversely across the colon and cut away the tumor by severing the intestine between the two clamps. This will prevent any leakage from either end of the intestine. All of the vessels which have been clamped are now carefully ligated with catgut. At any point at which there seems to be danger of the ligature slipping off it is best to place a catgut suture about the part included in the grasp of the hæmostatic forceps.

After perfect hæmostasis has been attained a suture is applied to the surface of the transverse colon four inches from its cut end, as shown in Plate XLIX. Care should be taken to have the ascending and descending thread in this suture not more than one-eighth of an inch apart. The intestine is now held between the finger and thumb of an assistant six inches beyond this point. Its end is enveloped in a pad of moist aseptic gauze. The clamp which had up to the present time closed the cut lumen of the colon is removed. Any bleeding points are caught with hæmostatic forceps and ligated. A short cut, Plate XLIX a, is now made through the wall of the colon, half-way between the two threads of the suture. The Murphy button is carried into the lumen of the intestine and its central projecting tube is carried out through the incision just made. The ligature is tied to hold the button firmly in place, although this is scarcely necessary, because the opening is just large enough for the central projecting tube of the button to protrude. The open end of the colon is now closed by two rows of continuous sutures of fine silk, the first row grasping all of the layers and the second row of Lembert sutures serving to invert the first row into the lumen of the colon. The pledgets of cotton occluding the central tube of the Murphy button are now removed and the two segments of the button are united.

This completes the anastomosis. After carefully sponging off the surfaces and covering the defect in the peritoneum, caused by the removal of the cæcum and ascending colon, with surrounding peritoneum by means of a few catgut stitches, the abdominal wall is closed in the usual way.

In case the obstruction has been complete before the operation so that the patient is so greatly reduced in strength that it seems unwise to expose him to a prolonged operation, it is best to make

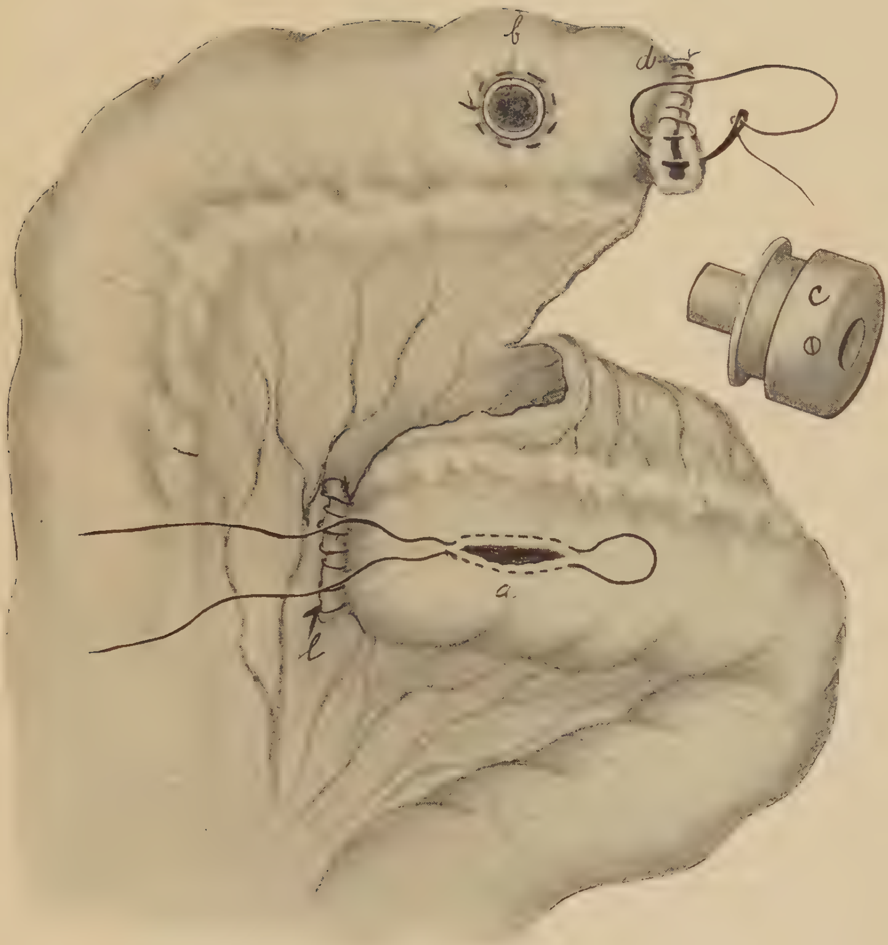


PLATE XLIX.

Lateral Anastomosis of Intestines with Murphy Button.

This plate does not show the end of the intestine properly; the tissue should be represented as inverted into the lumen of the intestine by means of Lembert sutures at (d) and (e). At (a) the purse-string suture is represented as applied properly, with the stitches near the edge of the incision. At (b) the segment of the button is in place and the purse-string suture has been tied. It is better to introduce the button through the open end of the intestine and to make a very small puncture of the wall, just sufficient for the central portion of the button to protrude, then to close the ends of the intestine. It will then not be necessary to apply the purse-string sutures at (a) and (b).

the anastomosis between the ileum and the colon at the first operation, in order to re-establish a satisfactory communication and then to make the excision of carcinomatous intestine after the patient's strength has been built up.

RESECTION OF THE SMALL INTESTINE.

This operation may be indicated by the presence of gangrene of the intestine in strangulated hernia or in volvulus, by severe laceration in gunshot or other wounds, by the presence of tumors or circumscribed tuberculosis or occasionally in cases of intussusception accompanied with gangrene. It may also be indicated by the presence of cicatricial stricture or intestinal fistula. The operation itself is very simple and more depends upon the proper selection of tissue than upon the technic of the operation itself. Whenever the operation is performed in the presence of gangrene care must be taken to go a considerable distance beyond the suspicious tissue. A patient is much safer if one yard of intestine has been sacrificed necessarily, than he would be if the excision were made at the very border of the gangrenous tissue.

In excising diseased intestine it is well to grasp the mesenteric vessels carefully as one progresses and to ligate them before resecting the intestine. In case it does not seem safe to apply simple ligatures the mesentery may be transfixed with sutures, in order to prevent slipping.

After a sufficient amount of intestine has been separated from its attachment to the mesentery, care is taken to stop at a point sufficiently distant from a large branch of the mesenteric artery to prevent the injury of the latter. The intestine is now held on either side by the hand of an assistant to prevent leakage, or this may be done by passing a narrow strip of gauze through the mesentery and tying just tightly enough to prevent extrusion. Then a large pair of long-jawed, clamp forceps is applied to either side of the portion to be excised, in order to prevent leakage from this portion. Then the intestine is cut away at either side, care being taken to cut away a little more from the point opposite the mesentery than on the mesenteric side.

Silk stitches are then applied, as illustrated in Plate XLVIII, being cautious to pass the stitch around the mesentery so as to hold its two surfaces together. The larger segment of the Murphy button is adjusted to the lower segment and the smaller one to the upper and then the two segments are adjusted to each other. It is well to turn them a little so that the mesentery of the one part does not fall directly opposite to the mesentery of the other. A few sutures should be applied to cover the defect caused by the excision of the intestine in order to prevent unnecessary adhesions to the denuded surfaces.

RESECTION OF THE COLON.

In case it becomes requisite to resect the colon we are confronted with a condition which is somewhat different, because the posterior surface of the colon is not covered with peritoneum. This makes an anastomosis much more troublesome, because union is much less certain in portions of the intestine not covered with peritoneum. In order to overcome this difficulty it is best to close the ends of the colon and make a side-to-side anastomosis of the two ends, choosing for this the surfaces covered with peritoneum, as illustrated in Plate XLIX.

In the transverse colon it is especially important not to infringe upon the attachment of the omentum for fear of causing subsequent necrosis. This anastomosis may be made by means of a Murphy button, but as there is liable to be an accumulation of hardened fæces in the upper segment, which would be likely to obstruct the lumen of the button, it seems best to make an anastomosis by means of suturing. It is usually still better to close both ends of the large intestine and make an anastomosis between the ileum and the colon below the point of resection, because in this way one secures the flow of liquid contents of the small intestine into the colon. In this case the button is perfectly safe.

The end of the colon is closed by applying a strong pair of forceps across the intestine at the point at which the resection is contemplated. This will crush the soft tissues out of the grasp of the forceps and leave only the fibrous tissue in place. Then a silk, purse-string suture is applied to the proximal side of these forceps. This is tied tightly, which will cause it to be buried in the groove made by the heavy forceps. Then the diseased portion is cut away, leaving the portion of the tissue held by the purse-string suture to project from the part of the intestine which is left. This is then buried in the end of the intestine by the application of a row of Lembert sutures.

For the sake of uniformity all of these operations for anastomosis connected with the stomach and intestine have been described as performed by means of the Murphy button. I have myself tested the usefulness of this appliance in a large number of these operations, and have found that it is most satisfactory if applied properly. The important points to be borne in mind in the use of the Murphy button are:

1. The button must be well made and must be kept open while not in use, in order to prevent injury to the spring.

2. The silk suture must grasp all of the layers of the stomach or intestine, but it must be applied very near the edge of the incision in order not to draw too much tissue into the bite of the button.

3. The incision through which the button is passed must not be too large, just large enough for the button to pass through.

4. The purse-string suture holding the button must be tied very tightly and the ends cut short and it is best to arrange the position of the knot so that the knots in the two segments do not meet.

5. If there is any projection of mucous membrane after the purse-string suture has been tied, this should be cut away before the two segments have been united.

6. When the two segments have been united there should be a perfectly smooth union throughout. If there is any projecting tissue it should be pressed in between the segments of the button by means of a spatula or the flat handle of a scalpel.

7. No sutures should be applied over the button.

8. The button must be placed in healthy tissue, never in the near vicinity of an ulcer or portion of the intestine which is in danger of becoming gangrenous.

Many surgeons object to the use of an appliance which has to remain in the intestine in the form of a foreign body, and these consequently prefer the use of a suture in place of the Murphy button or other appliance. All of these operations can be performed satisfactorily by the use of the suture. In my own work I have usually applied silk sutures in cases in which I did not use the button, but many surgeons prefer catgut.

The same points must be borne in mind in the use of sutures as in the use of the button, namely:

1. The surfaces to be united should be covered with peritoneum.

2. The immediate vicinity of the attachment of the omentum should be avoided.

3. The two layers composing the mesentery should be held together by a carefully applied stitch and the mesentery in the two segments should not be placed in accurate apposition.

4. The first row of sutures should grasp all of the layers of the intestinal wall, but the needle should grasp only a small portion of each layer.

5. The second row of sutures should be applied after the method known as Lembert sutures, which penetrate down to, but not through, the mucous membrane, thus placing in accurate apposition the peritoneal surface throughout the entire extent of the wound. The method has the advantage of affording an opportunity to make the anastomosis as large as one may desire. This is especially advantageous in making an anastomosis between portions of the colon, because in this intestine an extensive anastomosis is desirable. Interrupted or continuous sutures may be applied, but if the latter form is chosen, it is well to take a back stitch every fourth or fifth stitch, in order to insure greater security. Plate L illustrates the manner in which the sutures are applied in an end-to-end anastomosis, but the same principle will apply in case of a side-to-side or an end-to-side anastomosis.

After-Treatment.—In a general way the after-treatment corresponds to that employed after gastro-enterostomy with the difference that food is given by mouth a little earlier and that active cathartics are not given until the button has been passed. In case

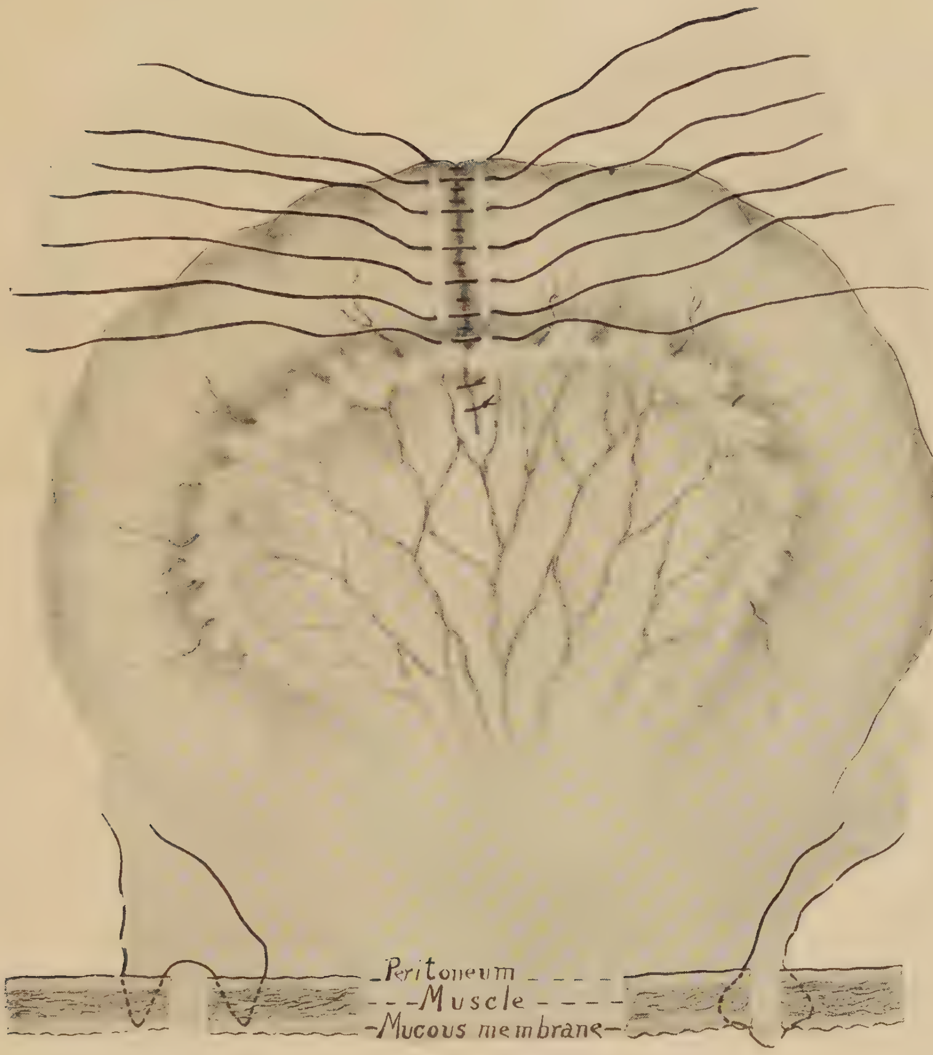


PLATE L.

INTESTINAL ANASTOMOSIS: END TO END WITH SUTURES.

Herewith the manner of introducing the sutures is illustrated. To the right the suture grasps all of the layers of the intestine; this suture is first applied. To the left the suture passes through all the layers, including the submucous connective tissue, but not the mucous membrane, then passes out through all of these layers, issuing near the edge of the wound, then passing in and out again on the opposite side of the wound it is ready to tie. It will then unite two serous surfaces. This is the second row of sutures. This is Lembert's suture. Above, both rows are in place, but the outer row has been left untied. The latter is represented as interrupted, but continuous sutures may be used and these are preferred by most surgeons.

the colon is involved in the operation predigested foods are given by mouth from the third day on and nourishment by enema is not employed. Hot water in small sips is given by mouth shortly after the operation and continued for the first few days.

One can easily choose a predigested food which is absorbed almost entirely from the stomach, which will sustain the patient until the union between the united ends of intestine is sufficiently firm to make the use of general liquid diet safe. Ordinarily a very firm union exists after the third day, but occasionally the patients in whom these operations are indicated are much reduced in strength and consequently their tissues do not heal so rapidly.

INGUINAL COLOSTOMY.

The only condition indicating an inguinal colostomy is a stricture of the rectum which cannot be excised. This may be due to carcinoma or cicatricial contraction following a tubercular or a syphilitic ulcer or an acute infection.

The operation may be intended only for temporary relief until the constricted portion of the rectum may be excised and the continuity between the intestine above and below this constriction has again been established, or it may be for permanent use. If it is intended only for temporary use it is not necessary to provide for a means of keeping this opening closed at times to guard against the involuntary evacuation of the bowels. If the intestine is, however, intended to remain permanently open, it is desirable to secure such a provision. For the sake of brevity I will describe only the latter operation, because it happens frequently that a colostomy which is primarily intended to be only for temporary relief will later be maintained permanently, either because it is not possible to establish a satisfactory communication through the natural way, or because the patient is so comfortable that he refuses to submit to the necessary operation to establish the communication through the rectum.

Operation.—An incision is made parallel with Poupart's ligament, two and one-half inches in length, two inches above the anterior superior spine. Its center is crossed by a line extending from the left anterior superior spine of the ilium to the umbilicus. This line extends down through the external oblique abdominal muscle, whose fibers it separates but does not cut.

The internal oblique abdominal muscle is then separated in the direction of its fibers, which extend nearly at right angles with the fibers of the external oblique. Then the transversalis fascia and peritoneum are severed in the same direction. This incision corresponds exactly to the McBurney incision, which has been described in the chapter on appendicitis, with the exception that it is on the left instead of the right side of the abdomen. With this incision the two abdominal muscles are not impaired, because none of their fibers have been cut at right angles, and they are in a condition in which they can readily act as sphincter muscles.

A second incision is now made parallel with the first and of the same length, but one and one-half inches nearer the anterior superior spine of the ilium. A third incision uniting these two at the upper end is made and the flap of the skin thus formed is dissected loose and covered temporarily by a piece of moist antiseptic gauze. The finger is then inserted into the abdominal cavity and passed along the ilium until it reaches the sigmoid flexure of the colon. This is withdrawn through the incision in the abdominal wall. It can readily be recognized as large intestine from the fact that the longitudinal band of muscle fibers extends parallel with its upper surface and that there are attached to it numerous masses of fat, the appendices epiploica. It is best to bring out the upper segment of the sigmoid as much as possible, in order to prevent it from prolapsing later on, a condition which occurs frequently in cases in which this precaution has not been taken.

The intestine is now held up to the light in order to select a point in its mesentery through which an opening can be torn without disturbing any of the large blood vessels. This opening must be sufficiently large to admit the flap of skin which has been prepared. The upper segment of the intestine is then placed outward and the lower segment inward and the skin flap is drawn through the opening in the mesentery. In this manner the upper segment is bent over the outer edge of the abdominal wall and underneath

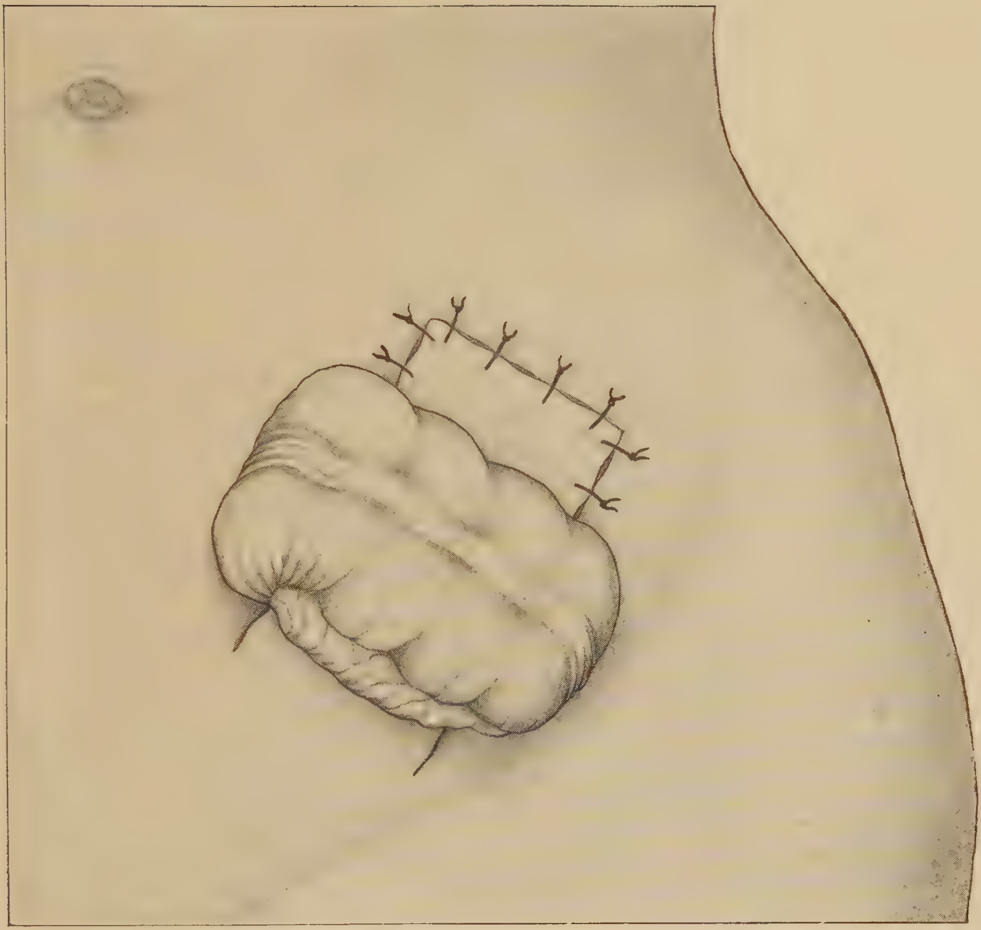


PLATE LI.

Inguinal Colostomy.

The colon is drawn out through the incision in the abdominal wall; its mesentery is split; a rectangular flap of skin is cut and drawn through the slit in the mesentery and sutured in place. The longitudinal muscular band is shown upon the surface of the sigmoid flexure of the colon.

the skin flap. Consequently, after healing has taken place the application of a pad over this part will cause the skin flap to act like a valve and will prevent the involuntary evacuation of the bowels. The incisions are now closed. In order to prevent any protrusion, a few stitches are inserted attaching the intestine to the skin. The operation is shown in Plate LI.

The loop of intestine is not opened until adhesions have formed, unless this is necessary on account of complete obstruction, in which case the wound is carefully protected and a large rubber tube covering a short glass tube is inserted into the upper segment and securely fastened by means of a strong purse-string suture. This will compel the contents of the intestine to pass out through the tube, which is passed through the dressing, without soiling the wound. If this is not necessary a dressing is applied which will permit the gas to pass through this loop. Cotton is rolled in long bundles and these are applied about the protruding intestine after the fashion of logs in a log cabin. These bundles are held in place by means of broad adhesive strips and an abdominal bandage.

After from two to five days the intestine is cut across and then the evacuations can occur without interfering with the healing of the wound. Aside from the advantage there is in securing a means of closing the upper segment when desired, this method has the further advantage of leaving the two openings of the intestine so far apart that there can be no passage of fæces from the upper into the lower opening. The evacuations will now occur through the opening a, which is sufficiently separated from the opening b, which communicates with the segment leading to the rectum, to prevent any of the evacuations from finding their way into this canal. This portion of the intestine can, however, be cleansed by irrigating through this opening.

In case it should become desirable later on to close the artificial anus this can be accomplished by inserting one branch of a clamp through each of these openings and gradually tightening the pressure until a communication has been established, when the openings can readily be closed.

After-Treatment.—Until the protruding loop has been cut only hot water and small quantities of predigested food are given by mouth. After this time general liquids, and after a week light diet is given.

This operation is usually performed in old persons greatly reduced in strength and these do not well bear lying quietly in bed. It is consequently best to permit them to occupy a semi-sitting position within a day or two after the operation and to leave the bed within a week or ten days later.

After the intestine has been opened a cathartic, preferably castor oil, should be given, and this should be followed by several enemata in order to remove fæcal accumulations which frequently exist in large quantities above the constriction, even if a diligent attempt has been made to evacuate the bowels before the operation. Frequently the lower segment contains many of these masses, which can usually be removed by irrigation but may occasionally require a blunt scoop for their removal. It is well to examine the opening by inserting the finger within the lumen of the intestine through the abdominal wall, because occasionally not sufficient space has been allowed for the evacuation of the bowels and the free passage of gas. This can be remedied readily by a slight incision.

These patients should be instructed to regulate their diet so as to avoid constipation and then to take a simple cleansing enema once a day to insure a free evacuation of the bowels. Thus they can usually be entirely free from any annoyance because of the artificial anus. A small pad of cotton should be worn over the opening, held in place by a simple abdominal bandage. In case there is any annoyance from escaping fæces a substantial pad may be held in place over the opening by means of an elastic bandage, which will compress the intestine underneath the skin flap, Plate LI c, over the edge of the abdominal wound sufficiently to overcome this annoyance.

If there is not enough force in the colon to effect an evacuation, it is sometimes best to insert a large rectal tube after giving the enema and to effect the evacuation through this.

Surgery of the Kidney.

In the consideration of surgery of the kidney especial stress should be laid upon diagnosis, because this is really the most difficult task connected with the subject. The examination of urine is most important, but it does not in itself result in a definite surgical diagnosis. The presence of albumen, tube casts and characteristic epithelial cells from the kidney indicate the presence of nephritis in one or both kidneys, but it does not make a surgical diagnosis. The presence of blood or pus indicates the presence of a bleeding or suppurating point in the kidney, the ureter, the bladder or the urethra, but again it does not definitely locate the diseased region; consequently these findings can act only as corroborative evidence and can serve to confirm a diagnosis made without their aid. Were it possible to obtain the urine from each kidney separately this difficulty would in a measure be overcome, because this would locate the source of these substances and would determine the diseased organ. At the same time it would be possible to learn whether the other kidney was sufficiently active to be depended upon to perform the entire work. In the female this can be done with comparative ease through a large speculum, the patient being placed in the knee-chest position and the bladder being permitted to inflate itself with air, which it does spontaneously whenever a speculum is inserted with the patient in this position. In the male, it can be accomplished with the aid of a cystoscope.

It is, however, to be remembered that the opening of the ureter into the bladder is a delicate mechanism which frequently prevents infectious material existing in the bladder from infecting the ureter and the kidney for a long period of time, and also that in cases in which one suspects a diseased kidney the bladder is very frequently not aseptic and one consequently runs the risk of infecting the other kidney also by carrying septic material from the bladder into the ureter. Moreover, it is likely that after the ostium of the ureter has once been distended for the introduction of a ureteral catheter it may no longer be so certain to guard against infection of the ureter and kidney from the bladder. A number of surgeons have observed infections of the kidney from the practice of ureteral catherization. It therefore seems at the present time to be an unwarranted procedure. However, the same result can be obtained without disturbing the ureter by producing a peculiar watershed in the bladder, causing the urine from each ureter to flow into a separate receptacle. This is accomplished by means of the Harris' segregator, which is illustrated in Fig. LII. The use of the instrument is described by Dr. Harris as follows:

"The instrument is used in the following manner: The patient, male or female, is placed comfortably on a table in the ordinary lithotomy position, with the hips slightly elevated. The instrument, with the flattened surfaces in contact so as to form practically a single catheter, is introduced into the bladder in the ordinary way. As soon as the proximal, curved extremity is within the bladder, the proper distance being indicated by the gradual scale, each catheter is rotated about its longitudinal axis until each proximal end, as indicated by the distal end, is directed outward and backward. The end of each catheter should pass through an arch of about 110 to 120 degrees, or so that the angle subtended posteriorly by the two catheters will be about 120 or 140 degrees. They are held in this position by a small spiral spring. The ends of the proximal extremity will now be in the neighborhood of, but not exactly at, the ureteral openings. The ends are separated a greater distance than the distance between the ureteral openings, so as to avoid the danger of compressing the opening of the ureter, and thus preventing the escape of the urine. The lever is now introduced into the vagina in the female or rectum in the male. By gentle pressure forward directly in the mid-line, the base of the bladder is raised into a longitudinal fold between the ureteral openings.

The curve of the lever is such that it fits nicely in the angle formed by the separating extremities of the catheters, thus forming a complete watershed. The end of each catheter now lies at the most dependent part of a little pocket, a perfect watershed separating the two. The ureters open, one on either side of the watershed near the base of the declivity in the immediate vicinity of the respective ends of the catheter.

By producing a gentle exhaustion of the air in the vials by

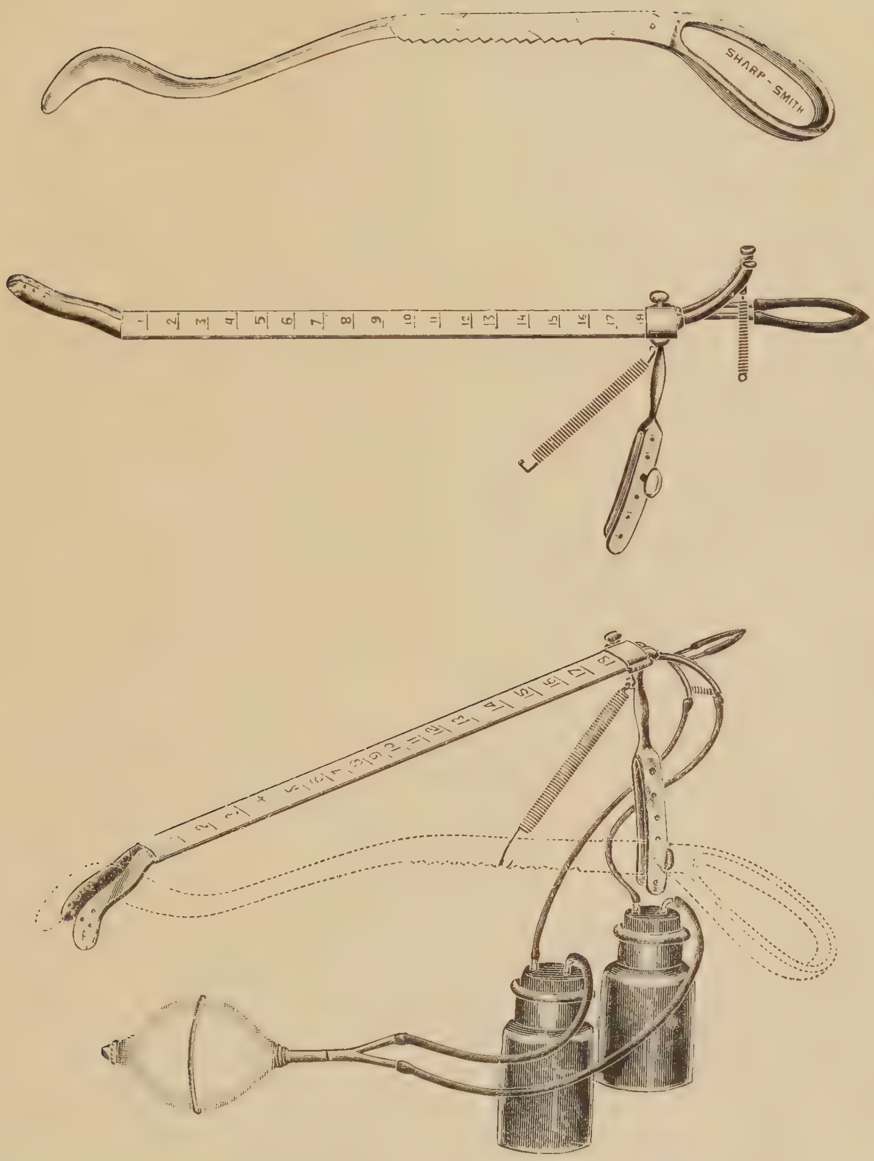


PLATE LII.
HARRIS' SEGREGATOR.

means of the bulb, the urine, as fast as it escapes from the ureters, drops directly into the ends of the catheters and flows at once into the vials, right and left, respectively.

The instrument and its application are so simple that its advantages are apparent at once, and hence need no arguments to support them.

This being the case, we may proceed at once to dispose of any possible objections that may suggest themselves.

The possibility of compressing the opening of the ureter and thus preventing the escape of the urine from that side is obviated, as already mentioned.

In diseased conditions of the vesical mucosa the value of an examination may, upon first thought, appear to be considerably lessened, owing to contamination of the urine with products of vesical origin. Upon reflection, however, this will be found not so. The bladder, when necessary, should be thoroughly cleansed by irrigation before introducing the instrument. After the instrument is in place the little pockets may be again cleansed by irrigating them directly through the little straight tubes on the distal end of the instrument provided for that purpose.

The urine, as fast as it escapes from the ureters, is sucked at once into the catheters, so that it does not remain in contact with the mucosa. The end of the catheter is so near the opening of the ureter that the urine comes in contact with an extremely small portion of the bladder surface. The examination is not continued long enough at any time for pus (for instance) to be formed in sufficient quantity to be taken up by the catheter. Hence, it will be seen that contamination, even when the bladder is diseased, will be slight.

It is likely that in certain greatly enlarged prostates or growths of the so-called middle lobe, or in vesical calculi or chronically inflamed and contracted bladders, the instrument would not be applicable, but such cases form a very small minority of those in which its use would be desirable.

The little straight tubes, when not being used for irrigation, must, of course, be closed air tight by simply tying the little rubber tubes attached to them, or passing the opposite ends of a single tube over each straight end. Aspiration with the bulb should not be too great so as to draw the mucosa into openings of the catheter. Very slight aspiration is all that is necessary. As a few drops of fluid are apt to remain in the bladder even after the use of the catheter, the first few drops that come over should be discarded.

The instrument should be opened carefully when in the bladder, so as not to excite hæmorrhage by injuring the mucosa. The proximal curve should be just within the bladder, which is determined by noting the length of the urethra on the scale. Introduce the instrument into the bladder and open it before introducing the lever into the vagina or rectum. The ends of the catheters are easily felt through the vagina or rectum, and the lever should be directly in the middle, midway between the two ends, and pressed snugly into the angle. Sufficient pressure should not be used to cause pain, as the watershed is very easily formed. The urine does not drop continually into the vials, but intermittingly, just as it escapes from the ureters. The use of the instrument is not painful and does not require an anæsthetic, except possibly in an over-sensitive or nervous patient, who would not submit to any manipulation whatsoever.

By attention to these simple rules the application of the instrument will be found very simple, and the results all that could be desired."

The instrument is contra-indicated only in cases in which its introduction is likely to cause severe traumatism on account of the inflamed condition of the urethra or the bladder. These cases can be easily eliminated and form but a very small proportion of all cases in which one might desire to make a separate examination of the urine from the two kidneys.

History.—This patient gives the following history: In good health as a child. Began to menstruate at fourteen; regular; painless. Married at twenty-two. Two pregnancies; labors normal. Second child four years ago. Has never felt well since. She had difficulty in emptying the bladder after the child-birth. On the eighth day after confinement she was taken with severe pain in right side of the abdomen, which lasted for about three months. Since then has had numerous attacks of pain in the same region, with intervals varying from one week to two months. Attacks vary in severity. Has been often confined to bed, and the attacks have been accompanied by fever and vomiting. Attack lasts from a few hours to three days. Patient often jaundiced during these attacks. About four weeks ago patient was taken with pain in the right side, accompanied with a severe bearing-down feeling. At this time she noticed a mass in the right side of abdomen the size of an orange. Has had no vomiting and does not think she has had much temperature with this attack. Pain has been almost constant up to the present time, but tumor has decreased somewhat in size.

Present Condition.—Greatly emaciated, appetite good, heart and lungs normal. Abdomen scaphoid. A considerable fluctuating mass, somewhat tense, extends from the right costal arch to a little below the umbilicus inward to median line. It is plainly palpable on bimanual examination with one hand in lumbar region and one on abdomen. It is quite tender and seems to move slightly on deep inspiration. Perineum is slightly lacerated; cervix also slightly torn. Cervix is long and hard. Uterus far down in pelvis, normal position, fornices empty, adnexa apparently not connected with mass above.

During the paroxysms or periods of illness there is always an increase in the size of the swelling and a decrease in the flow of urine, but the latter is less turbid at these times. As the flow increases and becomes more turbid the patient's condition improves and the swelling decreases in size.

Heart and lungs are normal. The urine contains a considerable amount of pus, but is otherwise normal. Upon examining the urine from the two kidneys separately, by means of the Harris segregator, it is found that the fluid secured from the left ureter is normal, while that from the right kidney contains pus.

Diagnosis.—The swelling is located in the vicinity of the right kidney and the ascending colon. Frequently an appendix is located as high up and sometimes a gall bladder is located as low down. The presence of jaundice and the persistent gastric disturbances might indicate an empyema of the gall bladder, or gall stones. The same conditions frequently occur in the case of a chronic recto-cæcal appendicitis. A tuberculosis of the ascending colon with adhesions between the omentum and transverse colon might cause the same symptoms. The two elements, however, which seem to establish the diagnosis are: 1. The fact that there is pus in the urine coming from the right kidney, and, 2. The fact that the condition is evidently the result of a puerperal infection which first affected the bladder and then the ureter, and, by way of an ascending infection, the kidney. This is still further confirmed by the regular variations in the size of the swelling and by the corresponding changes in the character of the urine. The patient lived in a small town in the mining regions at the time of her confinement, where she could not obtain medical care and good nursing; hence it is likely that there remained residual urine in the bladder for a considerable time and that the pelvis of the kidney was greatly dilated by the return pressure. The infection of the pelvis of the kidney probably occurred on the eighth day after confinement when the patient suffered the severe pain.

So long as there was fairly good drainage, from the distended pelvis of the kidney through the ureter, there were no serious symptoms, because there was but a slight amount of absorption, the pus being diluted with urine constantly secreted. But as soon as the ureter became temporarily blocked by an accumulation of thick pus, or on account of œdema, the confined urine became more septic and absorption more extensive. The increased pressure increases the pain, and the absorption increases the temperature. The gastric disturbance can be accounted for by the same conditions. Jaundice frequently accompanies abscesses of the kidney or the appendix, without direct involvement of the liver or the biliary tract, although these parts are frequently involved secondarily. The most important point in determining the differential diagnosis, however, is the demonstration of pus in the urine from the right kidney, and normal urine from the left. We can consequently make a positive diagnosis of pus in the pelvis of the right kidney without being able to positively exclude the presence of disease in the vermiform appendix and the gall bladder and biliary ducts.

The disease has existed for four years and the history of the case shows that the infection has probably extended upward through the ureter from the bladder. It is difficult to determine in any given case what secondary conditions may have resulted in this period of time. The fact that aside from the presence of pus the urine is nearly normal would indicate that no great amount of destruction of kidney tissue had occurred, but that the disease is chiefly confined to the pelvis of the kidney.

Obstruction to the flow of pus and urine from the right kidney during the periods of exacerbation of the disease might indicate an obstruction of the ureter due to the presence of a renal calculus, which could readily have formed with the conditions present in this case, or an occlusion due to the presence of thickened pus or to an œdema, or to an acute bend in the ureter. In case the obstruction is due to a calculus the relief which occurs when the calculus is displaced is usually much more sudden and more complete than it was in this case. Obstruction due to an acute bend of the ureter occurs only in cases in which the kidney is abnormally movable, which is not the case in this patient. However, so far as the treatment and the prognosis are concerned, it is immaterial to the patient whether this part of the diagnosis be made before or during the operation.

Indications for Operation.—It is plain that unless this patient obtains relief from her present condition she will continue in her downward course, which has become more and more marked as time has progressed during the past four years. The constant absorption of pus will not only continue to interfere with her nutrition by interfering with her appetite and her digestion indirectly, but it will undoubtedly result in amyloid degeneration, especially of the kidneys and the liver. The constant presence of pus in the bladder is likely to result in an infection of the pelvis of the left kidney, which has as yet escaped. Sooner or later, the tissues of the kidney itself will become inflamed, and then only the left kidney will remain to perform the labor of both organs. Aside from this there is always the danger of metastatic infection of other parts of the body from the presence of this accumulation of pus either by extension or by metastasis, because this is possible in case of an accumulation of pus in any part of the body if the drainage is not perfect. The only way in which relief can be obtained is by direct drainage by means of a free incision.

Preparation for Operation.—In order to insure against an accident which occurs rather frequently after operations upon the kidney—which consists in a complete absence in the secretion of urine by both kidneys and consequent uræmia—it is wise to provide for very free elimination before the operation is performed, first, by the administration of cathartics, and, second, by having the patient drink great quantities of distilled water, preferably hot. In the meantime the patient is placed for a week upon a simple milk diet.

In order to increase the activity of the glands of the skin, she will receive warm baths daily. On the day before the operation two ounces of castor oil will be given as usual. In this way it is possible to place the patient's kidneys in a fairly safe condition even in cases in which there has been much impairment of their function.

Operation.—The operation must primarily be exploratory, because the condition of the kidney must determine the operation to be employed. If the condition of the kidney is such as will preclude the possibility of its restoration to a normal condition, as a result of a conservative operation, then its removal is indicated, because the examination with the Harris segregator has demonstrated the fact that the left kidney is normal. On the other hand, if it is possible to preserve the kidney this must by all means be done. Were the other kidney not normal, it would not be wise to remove the diseased kidney, so long as any portion of it remains capable of excreting urine, even though it might not be possible to obtain a perfectly normal kidney as a result of the operation, because a patient can live longer with two impaired kidneys than with one.

Incision.—Beginning at a point near the twelfth rib an incision is carried downward toward the crest of the ilium through the edge of the erector spinæ and quadratus lumborum muscles, being careful to distinguish the ilio-hypogastric nerve and to retract it forward in order to avoid injuring it. It is well to make a free incision in order to expose the kidney well for palpation and inspection. This exposes the fat capsule of the kidney. Were we not practically certain of the presence of pus in this kidney, the condition of the vermiform appendix and the gall bladder could be determined with ease and safety by perforating the peritoneum in front of the ascending colon and making a digital examination of these organs.

The appendix can readily be removed through this incision, unless it is too extensively adherent, and it is also possible to remove gall stones from the gall bladder through the same incision, although the incision which has been described before is much to be preferred.

In this case, however, opening of the peritoneum would not be proper, because this would increase the likelihood of an infection of the peritoneal cavity.

The fat capsule is opened and a dark, oblong organ is seen in the wound. Grasping this between the fingers it is found to fluctuate. This is undoubtedly due to the presence of pus in the dilated pelvic cavity. An incision two inches in length is made through the cortex of the kidney a little behind the center of its convex surface, which is supposed to be the least vascular portion of the organ. Immediately there is a free flow of pus diluted with urine. The finger is inserted into the pelvis of the kidney and this cavity is carefully palpated, each calix being explored with the finger, in order to determine the presence of a renal calculus. The entire pelvis is lined with granulation tissue and there is a considerable amount of thickening of the tissues of the pelvis. The cortex of the kidney is thin and somewhat congested, but otherwise normal. A large probe with a bulbous end is introduced into the ureter and this is found free from obstruction by a stone.

It seems likely that drainage of the kidney would result in restoration to a fairly normal condition, and that the kidney will ultimately become nearly as useful as its fellow.

In order to stimulate the healing of the pelvic cavity, and at the same time establish free drainage, the pelvis will be tamponed carefully with iodoform gauze. A rubber drainage tube will also be inserted into this cavity, the gauze being tamponed around this. The drainage tube and gauze are carried out through the wound and the latter is sutured above and below it. A large dressing applied to the surface completes the operation.

After-Treatment.—Occasionally a hæmorrhage occurs upon removing the tampon which has been placed in the kidney, because the blood vessels in this organ are characterized by especially thin walls, making their closure very unstable. On this account it is wise to postpone withdrawing the tampon until it has been lossened by the development of granulations. It may be removed a little at a time until it has all been loosened. In the meantime the urine drains through the wound and the mucous membrane lining the ureter has an opportunity to become normal, because the flow of pus and urine through this canal no longer causes an irritation.

In cases like the one before us the urine usually becomes clear in a few days, because the drainage through the wound is so free that there is no accumulation. The pelvis of the kidney, which has been dilated for a long period of time, becomes contracted for the same reason, and all of the conditions become more nearly normal in a comparatively short time. It is wise to continue the drainage until there is no doubt but that the pelvis of the kidney and the ureter are nearly normal, so that natural drainage will be established.

The patient should receive an abundance of distilled water, in order to dilute the urine, which will form a non-irritating fluid as it passes over the diseased surfaces. In pyelitis, and in fact in other conditions, such as renal calculi, in which the pelvis of the kidney is diseased, distilled water given internally in considerable quantities is a most useful remedy. Many patients who have suffered for years from renal colic are permanently and perfectly relieved by the free use of this simple means. It seems necessary for the urine to possess a certain concentration in order to make the formation of renal or cystic calculi possible in the absence of foreign bodies, which may account for the clinical fact that I have just described. The free use of distilled water results in diluting the urine to such an extent that renal calculi or renal sand no longer form. Moreover, the urine becomes exceedingly bland and non-irritating, and I have frequently observed not only a relative decrease of the pus in the urine from dilution, but also an absolute decrease, as a result of drinking distilled water freely.

In case the ureter does not become normal in a relatively short time, which may occur, especially in cases in which the disease has existed for a long time, the wound in the kidney will not heal, and a fistula may persist, which is not only disagreeable because the dressings are constantly wet, but which results in an excoriation of the skin on account of the irritating effect of the urine, with which it is constantly in contact. In these cases, it is advisable to introduce a soft rubber retention catheter with a bulbous end into the kidney and to weight the free end by inserting a glass tube into it and then placing this in a bottle, which may be carried underneath the clothing, suspended from a belt. At night a longer rubber tube is attached to the catheter and its free end is passed out into a vessel outside the bed on the floor. This tube will act as a siphon and the patient will remain entirely dry. Occasionally the ureter does not recover, and then it will become necessary either to remove the kidney or to be satisfied with the drainage which has been established, together with all of the resulting inconveniences.

The quantity and quality of urine secreted by the diseased kidney can now be easily determined, and it will be apparent from this whether the kidney should be saved. So long as the opening into the kidney is too large for the use of a retention catheter, the quantity of urine can be determined by weighing the dressings before they are applied and after they have been in place for a given time.

NEPHRECTOMY.

Had we found this kidney hopelessly destroyed by the infection, or had the operation been performed for the removal of a malignant growth of the kidney, a nephrectomy would have been done through the same incision instead of a nephrotomy. In case a diagnosis of a malignant growth is made before the operation is begun I prefer the anterior incision along the outer edge of the rectus abdominis muscle. This incision can be prolonged sufficiently to remove a kidney under any condition without the necessity of pulling upon the tissues. In difficult cases the posterior incision which we have just made is not sufficiently long even though it be extended from the ribs to the ilium. Aside from the incision the steps of the operation are the same. The kidney is carefully loosened from the fat capsule in non-malignant cases. Then a pair of clamp forceps are applied to the vessels entering the kidney. These forceps should be perfectly reliable, but they should not be sharp at any point, in order not to injure the vessels. The renal veins are thin-walled and easily injured, consequently great care should be exercised in loosening the kidney. Dragging upon the renal vessels is dangerous, for the veins might easily be torn. After the forceps have been applied the kidney is cut away by cutting the vessels just as they enter the pelvis. The vessels which project beyond the forceps are now picked up separately, ligated with catgut, then a general ligature of catgut is passed about the entire pedicle. As this ligature is tightened the forceps are loosened so as to permit the ligature to compress the vessels in the pedicle to the fullest extent. In this way each vessel is ligated twice, which eliminates the danger to the patient from the slipping of a ligature.

If the kidney is small the ligature can be applied to the vessels composing the pedicle before the kidney has been removed without first applying the pressure forceps. In other cases in which it seems difficult to ligate the pedicle after the pressure forceps have been applied this may be avoided by simply leaving the forceps in place for twenty-four hours and arranging the dressing around this in a manner to prevent pressure upon the handles of the forceps. These forceps are loosened twenty-four hours after the operation and removed twelve hours later after the stump has withdrawn from the bite of the instrument.

The wound is sutured down to the forceps. In case the stump has been ligated it is well to leave a wick of iodoform gauze in the wound extending down to the stump, and which may be removed in a few days unless during the removal of the kidney the wound has become infected with pus spilled from an abscess. In this case a tubular rubber drain should be added to the gauze tampon.

Both the preparatory and the after treatment are the same in these cases as those in which nephrotomy is performed. It happens occasionally that the other kidney which has been fairly normal before the operation secretes little or no urine for several days after the operation. This, however, is not so common if elimination has been favored before the operation by the use of milk diet, cathartics and an abundance of distilled water as in cases in which this precaution has not been taken.

In case anuria occurs subcutaneous transfusions of a quart of normal salt solution once or twice a day, and the use of saline cathartics and steam baths, are indicated. Some of these patients suffer severely from nausea or vomiting, which is most readily relieved by thoroughly irrigating the stomach, through a siphon stomach tube, with normal salt solution as hot as it can be borne up to 110° F.

The hot gastric lavage alone is sometimes followed shortly by the secretion of urine. In other patients the same results may be obtained by giving a warm enema of one-half pint normal salt solution every hour.

From internal remedies I have not seen much benefit in such cases, and can consequently not speak of them with confidence.

Occasionally a kidney containing multiple cysts is encountered. Were these in only one kidney a nephrectomy might be indicated; but as this condition is usually present in both kidneys at the same time, and as there is consequently not very much kidney substance left, it is not wise to do a radical operation in such cases, because the operation is very likely to give the patient no relief, and usually hastens his death. It seems wiser to split the true capsule of the kidney throughout its length, to peal it back on each side, and to cut it away, and possibly to puncture the superficial cysts. This will relieve the tension upon the remaining kidney tissue, it will improve the blood-supply to the kidney, and it will not reduce the amount of kidney tissue.

This method has, however, not been sufficiently tried to have a position among recognized surgical operations, and I simply mention it here for want of a method I can recommend from personal experience.

If the kidney contains but a few cysts these can be excised without difficulty, and with safety to the patient, the defect being closed by one or two catgut sutures.

NEPHRORRHAPHY FOR THE RELIEF OF MOVABLE KIDNEY.

History.—The patient is a married woman, twenty-four years of age, the mother of two children, three and five years of age. She gives the following history:

Father died of pulmonary tuberculosis; otherwise the family history is good. The patient's health was good until one year ago, when she took a misstep and came down very forcibly on one foot. From that time on she suffered from a dragging pain in the right side of her back, just below the last rib. This has increased constantly. In the meantime she has also become very nervous, and has lost her former vigorous appearance. She is unable to do housework without greatly increasing her suffering. She locates her pain in the region of the right kidney. There are no digestion disturbances, no nausea or vomiting, but the patient suffers greatly from gaseous distention of the intestines.

Present Condition.—The patient is fairly well nourished; her appetite is fair; the bowels are regular. Heart, lungs and urine are normal. The right kidney can be palpated and moved beyond the median line and down opposite the anterior superior spine of the ilium. It can be carried up into its normal position, and when it approaches this point it slips into place very suddenly. When it is out of place the space which it normally occupies is found vacant upon bimanual palpation.

Diagnosis.—The same considerations as regards the differential diagnosis may be applied to this that were applied to the previous case. The only condition with which a movable kidney can be confounded, in a case like the one before us, is a pedunculated hydrops of the gall-bladder. Occasionally a gall bladder occluded by a gall stone will become distended to the size of the movable mass before us without becoming adherent. The neck of the gall bladder will become stretched and the latter will be movable in every direction. It frequently falls into a space in front of the left kidney and under the edge of the liver with the same little jerky motion that one feels in replacing a movable kidney. The thickness of the abdominal wall will make it impossible to observe the fluctuation of the fluid contained in the gall bladder, and it may be quite impossible to make a positive differential diagnosis between these two conditions until the abdomen has been opened. Another condition which is more easily differentiated, but which occasionally causes difficulty, is a tongue-like projection downwards from the right to the left of the liver. This may be six or eight inches in length, or even longer, and consequently its lower end can be dislocated a considerable distance. This mass is, however, continuous with the liver, and it is never quite as movable as the mass in the case before us, and it is always only its lower end which moves, the upper end being continuous with the liver. In my experience this condition has always occurred in patients with thin abdominal walls in whom a diagnosis could be made after a careful examination. Should the condition, however, exist in an obese patient, such a ready diagnonsis could probably not be made.

In this patient, the empty space which exists when the kidney is displaced is so distinct that there can scarcely be a doubt concerning the diagnosis.

Another test might be used by inflating the colon with gas by means of an air pump attached to a tube inserted into the rectum. The distended colon would pass below the mass if it were a distended gall bladder or a deformed lobe of the liver, while it would pass to the inner side of the mass if it were the kidney. This method, although theoretically of great value, is in practice useful only to confirm a diagnosis. If too much weight is placed upon this method the surgeon is likely to err in his diagnosis.

ÆTIOLOGY.—Aside from the traumatic cause for this condition, in the case before us, we have the history of two pregnancies, which is another common cause of movable kidney. In many of these cases a chronic appendicitis, gastritis, enteritis or gall stones, or all of these conditions, exist at the same time, and it is difficult to say whether or not there is any casual relation between these various conditions or whether their co-existence is merely a coincidence, or, again, whether they are all dependent upon an infection from the alimentary canal.

Indications for Operation.—In the presence of an anatomical lesion which may be easily removed, to which the patient's suffering is directly referred, and which preceded the presence of pain, there can scarcely be a doubt regarding the indication for operation.

Preparatory Treatment.—This should be the same as for ordinary abdominal sections.

Operation.—The same incision which has been described in connection with the previous case will be made, the fatty capsule opened, and the kidney brought up for inspection. It is quite normal, aside from the fact that it is so freely movable. The pelvis is not distended and it is evidently free from infection.

So large a proportion of patients suffering from movable kidney suffer also from chronic appendicitis and gall stones that I usually examine these organs at the same time, provided the kidney is free from infection. This can be done by making a small opening in the peritoneum in front of the colon, inserting one or two fingers and palpating these organs. In this case we find the gall bladder free from disease, but the appendix, which is four inches in length, club-shaped at its distal end and constricted at its cæcal end, contains a number of fæcal concretions. We will bring the appendix and the lower end of the cæcum out through the opening in the peritoneum and remove the former by the method described in the section on appendicitis. The opening in the peritoneum is then sutured with catgut and the operation upon the kidney is proceeded with.

The kidney is first brought out of the wound, as shown in Plate LIII, then its capsule is split longitudinally a distance of two to three inches and loosened from the surface of the kidney a distance of about one inch, as shown in the same plate. Next a strand of iodoform gauze is passed underneath the lower pole of the kidney, as shown in the same plate, and fastened to the capsule of the kidney by means of a fine catgut suture on either side. The kidney, together with the attached gauze, is then replaced in the body, as shown in Plate LIV, and the true capsule of the kidney is sutured to the fascia of the quadratus lumborum muscle by

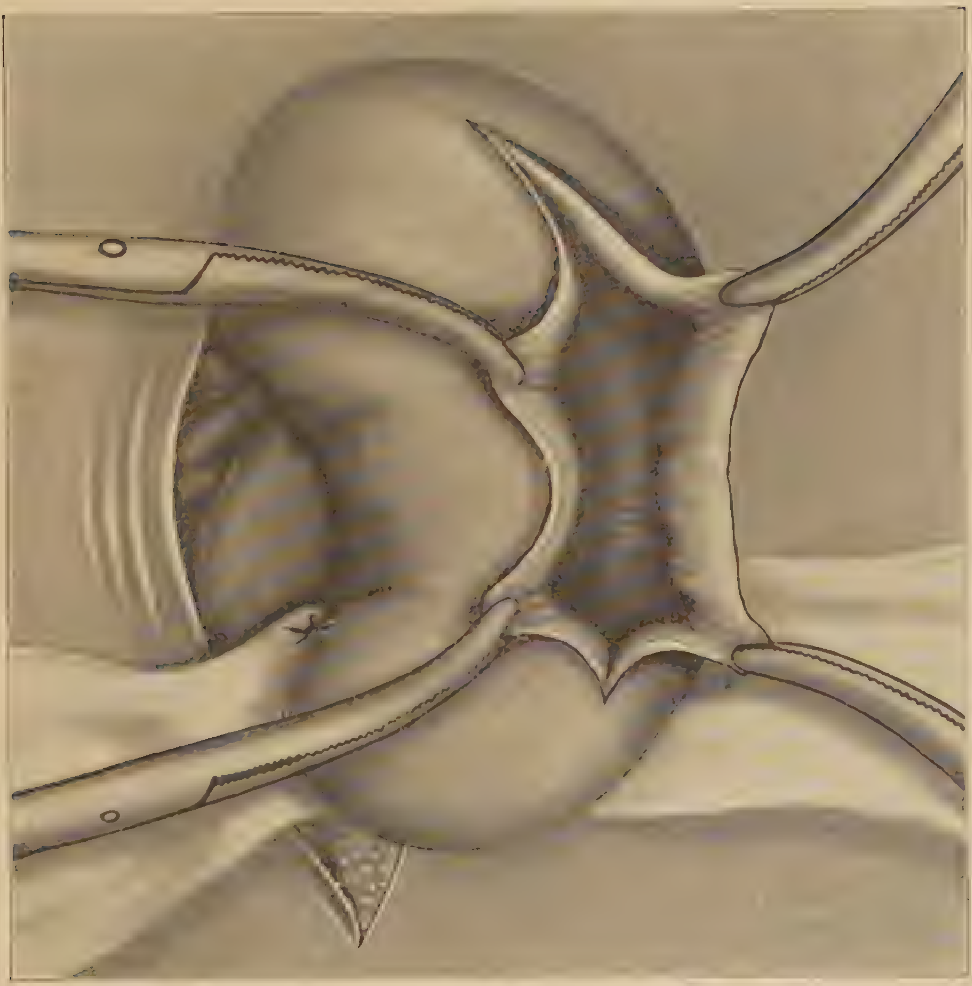


PLATE LIII.
NEPHRORRHAPHY.

The wound in the lumbar region should be drawn nearly twice as long as shown in the figure. The kidney has been delivered through the lumbar incision, its capsule has been split, a piece of iodoform gauze has been drawn through underneath its lower pole and has been fastened in place by means of two sutures through the capsule. The capsule has been separated from the surface of the kidney for a distance of eight centimeters in length and three centimeters in width.

means of a number of chromicized catgut sutures, as indicated in Plate LIV. A small strand of iodoform gauze is passed down to the denuded surface of the kidney, and then the entire wound is sutured, with the exception of the space occupied by the strands of iodoform gauze. These are removed about ten days or two weeks after the operation; by this time vigorous granulation tissue will have developed, which will form connective tissue to keep the kidney in place.

Many surgeons perform this operation without the use of the gauze and claim equally perfect results, hence this part of the operation can hardly be considered absolutely necessary. It seems as though, in this case, the removal of the appendix, with its enteroliths, is likely to give the patient quite as much relief as the nephrorrhaphy. This has been borne out by my clinical experience. Patients in whom no lesion is corrected except the movable kidney, rarely make a satisfactory recovery, while quite the contrary is true of cases in which some other important lesion has been found and corrected.

The amount of displacement which we have found in this case might easily have caused an obstruction of the ureter and a consequent hydronephrosis. This may occur as a result of an acute bend or a twist in the ureter. In either case simple drainage as practiced in the case described will result in the contraction of the dilated pelvis of the kidney, and suspension of the kidney in its normal position according to the method just described will prevent the obstruction to the ureter in the future; consequently a permanent recovery may be expected unless ulceration has resulted from the distortion of the ureter, and this in turn has produced cicatricial constriction forming a fibrous stricture. The degree of constriction will determine the form of treatment in these cases. If the constriction is only moderate simple drainage of the hydronephrosis, together with nephrorrhaphy, will result in a sufficient degree of relief to promise a complete recovery because the connective tissue will become softer and the œdema will be reduced and consequently the passage of the urine through the ureter will become more and more free and presently all of the urine will pass in the natural way. If, however, the constriction is great nothing less than a nephrectomy will usually suffice to give relief to the patient. It is, however, to be hoped that in the future plastic operations or resections of the ureter will yield more satisfactory results than at the present time. It is not likely that dilatation with bougies or sounds will ever accomplish much in these cases because of the difficulty one encounters in introducing bougies, the danger of rupturing the thin-walled ureter, the danger of infection, and the lack of permanency of results after dilatation, which we have had abundance of opportunity to observe in the dilatation of strictures in other tubes in the body.

COMPLICATIONS OF FLOATING KIDNEY.

A considerable proportion of the patients suffer at the same time from other intra-abdominal diseases. Many of them have at some time suffered from acute appendicitis complicated with peritonitis followed by extensive adhesions. It seems reasonable to suppose that these adhesions would have a causal relation to the development of floating kidney either by producing direct traction upon this organ or by necessitating an abnormal amount of intra-abdominal pressure to force the intestinal contents through the intestines in the vicinity of the appendix and especially through the ileo-cæcal valve.

A considerable number of these patients also suffer from gall stones. It is difficult to establish a reasonable causal relation between these two conditions, although such a relation between gall stones and appendicitis is much easier to explain and it is possible that both gall stones and floating kidney in these cases are secondary to appendicitis, although this has by no means been proven. The frequency of these two complications explains the failure in obtaining symptomatic relief in many patients suffering from floating kidney in whom the anatomic result after nephrorrhaphy has been perfect.

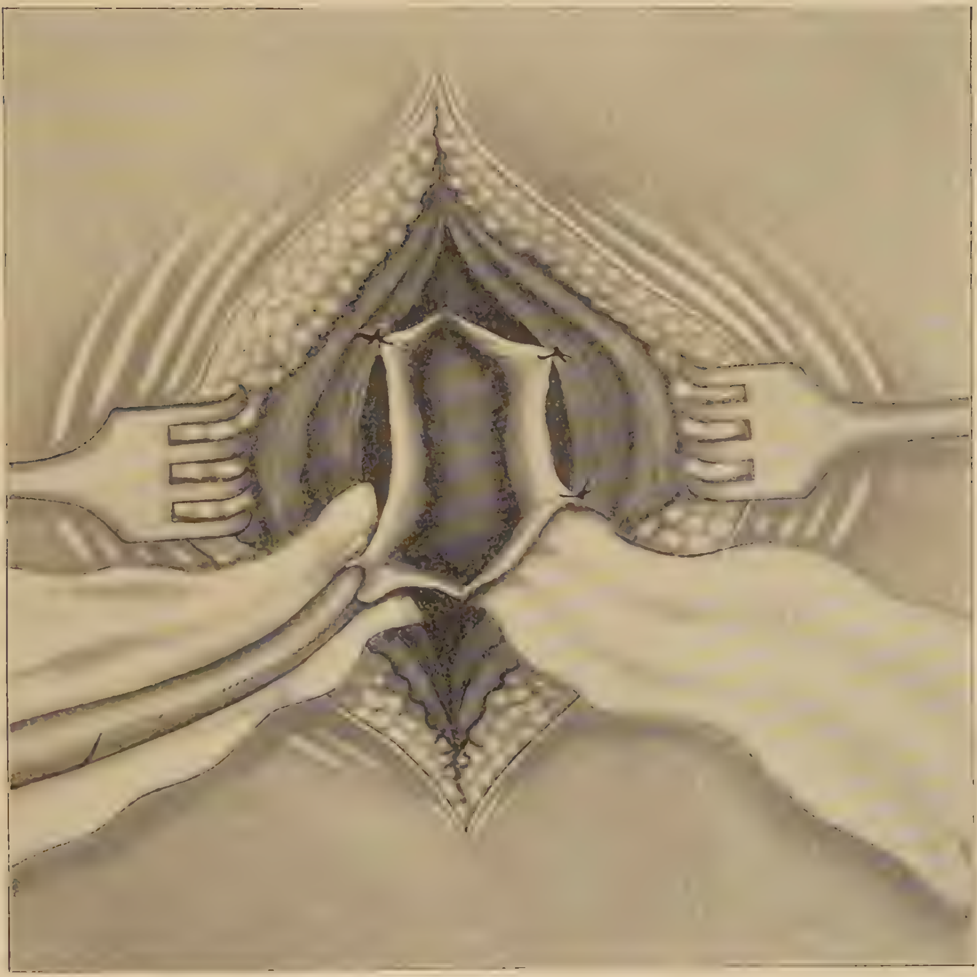


PLATE LIV.

NEPHRORRHAPHY.

The kidney has been replaced, its lower pole being supported by a strand of iodoform gauze. The loosened capsule has been sutured to the muscles and fascia in the lumbar wound.

DECAPSULIZATION OF THE KIDNEY FOR CHRONIC NEPHRITIS.

While speaking upon this subject it seems proper to describe a relatively recent operation upon the kidney which has not as yet earned a position among recognized operations, but which seems to be based upon reasonable principles. I refer to the operation of removing the true capsule of the kidney for the cure of chronic nephritis.

The same incision is made as in nephrorrhaphy; the capsule is split in the same manner but throughout the entire convex surface of the kidney. It is then carefully stripped down on either side and cut away, leaving the entire surface of the kidney in contact with the surrounding tissues. It seems that new blood vessels form in great numbers and that the remnants of kidney tissue which have not yet been destroyed by the disease will suffice to carry on the function of the organ to a very marked extent after this operation.

As I have stated above, however, this procedure has not as yet passed through a sufficient period of observation to be established as a recognized oueration.

RESECTION OF THE KIDNEY.

This operation is but rarely indicated, because the reason for which one would be likely to perform it is for the removal of tumors. The kidney is so seldom the seat of benign tumors that this condition scarcely deserves consideration, the small benign cyst having been mentioned before. In malignant disease of the kidney even the complete removal of the organ promises but little; hence a resection would almost certainly be followed by a rapid recurrence. In severe crushing injuries a resection sometimes becomes necessary. In these cases the extent of the excision will depend upon the extent of the trauma. It should be in the form of a wedge-shaped piece in order to permit of the closure of the defect.

Sutures are likely to cut through the kidney tissue if applied directly, but if the suture is passed through gauze folded upon itself from two to four times, then through both edges of the wound, then again through layers of gauze, then back in the opposite direction, it can be tied without cutting. These sutures should be of cat-gut, which will last about ten days before being absorbed. The strips of gauze may be permitted to project from the wound so that they may be withdrawn when they are freed by the absorption of the cat-gut sutures.

The same plan may be employed after nephrotomy if the hæmorrhage is so severe that it cannot be controlled by tamponing. In case drainage of the pelvis of the kidney is desired, in a case in which this plan is indicated because of severe hæmorrhage, one or two rubber drains may be wrapped in iodoform gauze and inserted into the pelvis of the kidney, and then the sutures are applied as before, the cut edges of the kidney being thus pressed against the gauze surrounding the rubber drains.

EXCISION OF THE URETER.

In case the ureter is diseased in connection with the kidney, which is not uncommon in tuberculosis, it may be excised by following it from above downward. If disease of the ureter is diagnosed before the operation is begun it is better to make an oblique incision so as to carry the lower end thereof to a point near the anterior superior spine of the ilium, provided the posterior incision has been chosen. If the anterior incision has been selected it is well to split the outer edge of the rectus abdominis muscle longitudinally. This incision can be lengthened to suit the convenience of the operator. When the bladder is reached the ureter is cut off and a small purse-string suture is applied to cover the stump. The wound is then closed with two or three rows of cat-gut sutures, unless infection has taken place from an ulcerated ureter or from pus in the pelvis of the kidney, in which case the wound should be drained with iodoform gauze above and below and the intervening portion sutured in order to prevent the formation of a hernia. After the kidney and the ureter have been removed the suppuration will subside rapidly, even if it has not been possible to effect the removal without spilling some of the pus contained.

SPLENECTOMY.

This operation is indicated, aside from cases in which the spleen is the seat of a severe traumatism, only in patients in whom the size of the spleen is in itself a burden, and in whom medical treatment diligently applied has failed to relieve. It is contra-indicated in cases of splenic leukæmia because the patients regularly die of shock or hæmorrhage while they frequently live in relative comfort for a considerable period of time if not operated.

History.—The patient before us is a school boy twelve years of age, giving the following history:

He has lived in this city since birth, has never been strong, but until two years ago he had never been sick in bed. At that time he began to feel weak and languid and to lose in flesh and look badly. At the same time he noticed a small swelling in the left hypochondriac region. All of these conditions have slowly but constantly become worse ever since this time, notwithstanding constant treatment. He came under our observation two months ago, since which time he has been treated continuously. First he received tonics containing arsenic, then phosphorus; then he was given two grains of quinine in solution every two hours night and day in order to keep fresh quinine in his circulation constantly to counteract any malarial infection which might have escaped detection; the examination of the blood having failed to show the presence of the plasmodium of malaria. All of these forms of treatment had a negative result. The same was true of the use of iodide of potassium, which had been employed experimentally some time before.

Present Condition.—Somewhat emaciated, anæmic boy, tongue coated, appetite fair, bowels slightly constipated, pulse 70, lungs and kidneys normal. Examination of blood shows a count of 3,500,000 red corpuscles; no leucocytosis. The lymph glands are nowhere enlarged. The abdomen is considerably more prominent on the left than on the right side. Palpation shows a tumor extending from a point one inch below the left costal arch to a point an inch above the anterior superior spine and a little beyond the middle line to the right. Pressing forward from behind the tumor moves toward the right side of the abdomen. Several deep notches can be felt in the relatively sharp edge on the right side. The tumor is not freely movable. It is slightly displaced by respiration.

DIAGNOSIS.—The most characteristic feature in this case is the form of the tumor, being oblong from above downward with a sharp border on its right side and distinct notches in this border.

All of these characteristics would not be present in a tumor of the kidney or the descending colon, the only organs upon which tumors occasionally develop in this vicinity, hence an enlarged spleen is the only probable diagnosis.

INDICATIONS FOR TREATMENT.—Internal treatment has been patiently and carefully employed for two years, and during the past two months under our observation. Had the spleen been enlarged because of a malarial infection the treatment with quinine and arsenic would have made an impression upon this case. The diagnosis of malaria seemed plausible because the child has lived near the north branch of the Chicago river in a vicinity infested with mosquitoes, which breed in the clay holes of an old brickyard which contains stagnant water and refuse. It is true that the examination of the blood failed to discover the plasmodium, but this might be accounted for by the chronic condition, which makes it much more difficult to find the parasite. The tumor continues to increase in size and encroaches upon the other organs.

Were the proportion of white to red blood corpuscles greatly increased, indicating the presence of leukæmia, an operation would be positively contra-indicated, because in that case either primary or secondary hæmorrhage is sure to occur and the patient never survives the operation if this condition is at all advanced.

The blood must, of course, be examined repeatedly for the presence of the plasmodium malariæ, because its presence would indicate the possibility of obtaining a reduction in the size of the spleen by the use of quinine and arsenic. The former remedy should be given in solution in two or three grain doses every two hours night and day. This method insures the presence of fresh quinine in the body constantly and is much more effective in these chronic cases than when given in larger doses at longer intervals; indeed, many cases in which enormous doses of quinine given from two to four times a day had no permanent effect after treatment for weeks or months, recovered after two weeks' treatment by this method.

Operation.—The length of the incision will depend upon the size of the tumor. It is most convenient to make it along the outer border of the left rectus abdominis muscle or through the outer edge of this muscle. It is well to make the incision quite long enough to permit of all the manipulations without crowding, because the safety of the operation depends largely upon the absence of traumatism.

It is important to loosen the peritoneal support of the spleen before the blood vessels are interfered with. First the phrenosplenic ligament is grasped between two pair of large pressure forceps and cut between these. The phrenic end is then carefully transfixed and ligated, the forceps on the splenic end being left in place. Then the peritoneal support not included in this structure is treated in the same manner.

If there are any inflammatory adhesions they are treated as in all other intra-abdominal operations. When the spleen has been made free slowly and carefully without unnecessary traumatism down to the hilus to which is attached the gastro-splenic omentum which contains the important blood vessels, this is loosened above and below to form a pedicle, which may be grasped with a pair of heavy pressure forceps, or it may be transfixed with a blunt aneurism needle and tied in halves with cat-gut, a second ligature being applied around the entire pedicle at a point one-eighth or one-fourth of an inch away. The pedicle is then cut beyond these ligatures and the separate branches of the hepatic artery and vein may be tied once more separately. If the pressure forceps are applied instead of first ligating the pedicle, the pedicle may be cut a short distance beyond the forceps; then the vessels may be picked up at their ends and ligated separately, and then the ligature may be thrown around the pedicle just above the point at which the forceps were applied. The forceps are taken off while the ligature is being tied, which will permit the latter to slip into the groove made by the former.

Any raw surfaces which may remain are covered with peritoneum by means of cat-gut sutures.

In case there are areas which cannot be covered, from which there is a considerable amount of oozing, they should be tamponed with iodoform gauze, which should be permitted to protrude from the wound; otherwise the wound is closed in the usual manner, great care being taken to have each layer in accurate apposition.

After-Treatment.—The after care of these patients is the same as following other abdominal sections.

WANDERING SPLEEN.

Occasionally a spleen will become extremely movable so that it may be carried to all parts of the abdominal cavity. This may be accompanied by a considerable amount of suffering in the form of acute pain and digestive disturbances.

In these cases the phreno-splenic ligament is drawn out so that it no longer serves as a support, and the other peritoneal support is equally useless.

Operation.—The incision described in the previous operation is again employed, then the outer edge of the wound is retracted thoroughly and a pouch is formed out of the parietal peritoneum and transversalis fascia sufficiently large to conveniently hold the spleen which is sutured in place. What is left of the phreno-splenic ligament is utilized in fastening the spleen in this position. In performing this operation care should be taken not to do anything which might interfere with the blood vessels in the gastro-splenic omentum.

OPERATIONS UPON THE PANCREAS.

Drainage of the gall bladder, and thus indirectly of the common duct and the pancreatic duct, has been considered in connection with the treatment of pancreatitis complicating cholecystitis. The same treatment is indicated in acute pancreatitis because it provides the only free drainage which is available.

In cysts of the pancreas resulting from a total occlusion of the duct of the pancreas, usually due to traumatism, the treatment consists in making an incision either in the median line or through the rectus abdominis muscle. The tumor will be found to be retro-peritoneal because the pancreas is a retro-peritoneal organ. The surrounding organs are tamponed away by means of moist aseptic pads, then the cyst wall is exposed by making a slit in the peritoneum. The cyst is then tapped with a trocar, then opened and the remaining fluid sponged away with moist pads. Then the cavity of the cyst is tamponed lightly with iodoform gauze and the edges of the wound are sutured to the parietal peritoneum and transversalis fascia in the upper angle of the wound. The remaining portion of the wound is then closed in the usual manner.

After-Treatment.—The iodoform gauze is gradually removed. If there is no further secretion after this has been done no further drainage is instituted, but if secretion continues a drainage tube is inserted when the tampon has been removed and this is kept in place until the discharge subsides, which usually occurs in a relatively short time, the cyst becoming obliterated by the adhesion of its walls.

Surgery of the Pelvis.

OVARIAN TUMORS.

History.—The early history in cases of ovarian tumors is usually negative, the growth being discovered by accident. Among educated people in the higher classes of society such a tumor is usually discovered during a careful physical examination made by the family physician in the course of some illness of the patient which has no relation to the presence of the tumor. Thorough physical examinations are now so commonly made that in this class of patients the growth is usually discovered before it has advanced to any great size.

It is quite different among patients of the lower classes of society. Among these ovarian tumors are usually not discovered until they have attained a considerable size, when the patient discovers the growth herself. In a large majority of these patients a history of peritonitis at some time in the past can be established, provided the conditions are favorable for obtaining a perfect history. In many cases the time is so remote that it becomes necessary to inquire from the parents regarding the patient's sickness during childhood.

The peritonitis in early youth and childhood is usually due to appendicitis or typhoid fever, and occasionally to scarlet fever. Later on in life it is more commonly dependent upon a specific infection through the uterus and tubes, and still later to puerperal infection following childbirth or abortion.

These infections are certain to leave the ovaries covered with connective tissue which would favor the formation of retention cysts in the Graafian follicles.

Varieties of Cysts.—The cysts may be simply retention cysts formed by the distention of Graafian follicles with serum secreted from the lining of these follicles. These may be simple or multiple, and may remain small or they may attain enormous size. The largest one I have personally encountered weighed eighty-one pounds in a woman weighing seventy pounds after the tumor had been removed. Cysts of this variety have, however, been reported weighing much more.

Again the epithelial lining of the Graafian follicle may take upon itself an abnormal development, forming a papilloma or a carcinoma. In this case the cyst contains gelatinous, viscid fluid. The papillomatous or carcinomatous growth may perforate the cyst wall and may infect the peritoneum covering the intestines, or the parietal peritoneum, and then the free peritoneal cavity may contain serous or gelatinous fluid.

It frequently happens that this growth invades the surrounding organs and gives rise to complications which are always serious in character ultimately.

Occasionally a portion of the ovary is located in the broad ligament and may in this location give rise to the formation of a cyst known as a cyst of the broad ligament, or intra-ligamentous cyst.

A tumor may consist of a simple retention cyst in one part and a papillomatous cyst in the remaining portion.

It seems likely that many of these tumors which are primarily simple cysts, later on degenerate into papillomatous cysts, and these in turn into carcinomatous tumors.

Diagnosis.—Small ovarian cysts are diagnosed by bimanual examination. They are recognized as more or less spherical masses located in the pelvis. They may lie to the right or left, behind or in front or above the uterus.

Unless there has been a recent pelvic peritonitis they are likely to be movable and can be separated from the uterus. If the abdominal walls are not very thick fluctuation can usually be recognized.

Later on when the tumor has attained considerable size it rises in the pelvis and ultimately is forced by its size to occupy the abdominal cavity above the pelvis. Fluctuation can now usually be established across the abdomen. The tumor displaces the intestines, consequently percussion over its most prominent portion gives rise to a dull sound. Above and to either side there is resonance because of the location of the stomach and transverse colon. A change in the position of the patient makes no change in the percussion sounds. It is movable unless strongly adherent on account of peritonitis.

Differential Diagnosis.—Early in the disease it is most easily confounded with pediculated fibroid tumors of the uterus. The latter are, however, harder, more closely connected with the uterus, and there is with these usually a history of menorrhagia.

Extra-Uterine Pregnancy may be mistaken for ovarian cyst early in its development, but the absence of menstruation is likely to clear up this diagnosis.

Pyosalpinx occasionally simulates an adherent ovarian cyst, but its location and the indications of a more or less septic condition usually suffice to determine a diagnosis.

Later on abdominal ascites may be mistaken for an ovarian cyst. An examination of the urine and the heart will establish a nephritic or cardiac cause for the ascites. In the physical examination it will be found that the area of dullness varies with the position of the patient in abdominal ascites, unless this is due to tuberculosis with the presence of adhesions.

It frequently occurs that the intra-abdominal organs are completely fixed by the presence of adhesions due to tubercular peritonitis, and that the intestines and omentum form a wall above, and the pelvic organs together with the sigmoid flexure of the colon make a dam below the free ascitic fluid, causing the latter to become encapsulated, as it were, between the abdominal wall in front and these two barriers above and below. In these cases the percussion sounds are quite as constant as in the presence of an ovarian cyst, making the differential diagnosis from the physical examination virtually impossible. The history in such cases will show that the intra-abdominal accumulation was diffuse during the early part of the disease, but this is not always observed, because the surgeon is not consulted until later. There is also an evening temperature in these cases during some part of the attack, but this again is not always observed, and when the patient comes under the observation of the surgeon the temperature is no longer abnormal.

Obesity.—Every year I have a number of patients sent to me with a rather acute, circumscribed obesity or lipomatosis of the lower portion of the anterior abdominal wall, with the request to remove an abdominal tumor. Usually a diagnosis of ovarian cyst has been made on account of the presence of pseudo fluctuation in this mass. The patients are usually obese, but their general condition is slight compared with the local condition, and unless one's attention has been directly called to this condition a mistaken diagnosis is most natural. This can be avoided by grasping the mass laterally and lifting it, which will show it to be entirely in the tissues of the abdominal wall and not within the abdominal cavity.

Hydronephrosis.—A hydronephrosis is not uncommonly associated with movable kidney, and this mobility may be so excessive as to permit the kidney to move to almost every portion of the abdominal cavity, and, in fact, it may be so movable that it can be palpated in the pelvis. In this case the morbidity may be mistaken for ovarian cyst. This condition is, however, uncommon. It usually begins in the region of the right kidney; there is irregularity in the size of the tumor, and the decrease in its size is associated with the free evacuation of urine. The tumor can be replaced in the right hypochondriac region, and when thus replaced the condition just spoken of is liable to occur, because this disposes of the acute flexion of the ureter. There are, however, some cases in which it will, undoubtedly, be impossible to make a positive differential diagnosis.

A movable spleen, or liver, has occasionally been mistaken for an ovarian cyst. This is also true of cysts of the pancreas. Very rarely a greatly distended gall bladder may be exceedingly movable, in fact, quite as movable as a hydronephrosis, and in such an instance it may be mistaken for an ovarian cyst.

These errors in diagnosis are much more common in patients with thick abdominal walls. The fluctuation which is due to the fat in the abdominal wall frequently causes an error of diagnosis by transmitting the sensation of fluctuation to solid masses, such as the liver or the spleen.

Occasionally an ovarian cyst has a pedicle sufficiently long to permit the tumor to be carried to any part of the abdominal cavity, and then it is likely to be mistaken for a tumor connected with some organ in whose vicinity it happens to be first discovered. In one instance I encountered a carcinoma of the pylorus as large as a fist which could be moved to every portion of the abdominal cavity and which was first discovered in the right inguinal region, and was mistaken for a cyst of the ovary.

These errors are, of course, quite uncommon, but it is well to bear in mind the possibility of their occurrence.

Ovarian Cyst with Twisted Pedicle.—At times an ovarian cyst with a long pedicle may develop to a considerable size without being noticed, until by some chance the pedicle becomes twisted upon itself and the nutrition of the cyst is suddenly interrupted because of the occlusion of the blood vessels contained in its pedicle. If the blood vessels are entirely occluded the occurrence is likely to be accompanied with severe pain, which may give rise to a diagnosis of appendicitis, rupture of extra-uterine pregnancy, gall stones, or renal calculus passing through the ureter. The abdominal walls are usually so tense after such happening that it is practically impossible to make a positive diagnosis without the use of general anæsthesia, unless the cyst is of appreciable size and the abdominal walls thin. The presence of a tumor will, of course, clear up the differential diagnosis with the exception of extra-uterine pregnancy, which, however, is characterized by the presence of increasing anæmia, and within a few hours after the beginning of the attack it is usually possible to palpate the coagulated blood in the cul-de-sac of Douglas by making a vaginal examination. This coagulated blood has a peculiar, doughy feeling, which, when once detected, will be readily remembered.

Distended Urinary Bladder—One other condition has been mistaken for an ovarian cyst more frequently than any other, but this is usually the result of carelessness and is practically always cleared up before an attempt is made to remove the cyst by means of an operation, because it is now the universal practice to catheterize the urinary bladder before undertaking an abdominal section. It has frequently happened that a distended urinary bladder has been regarded as an ovarian cyst, but the passage of the catheter invariably clears up this diagnosis; and a surgeon who has once

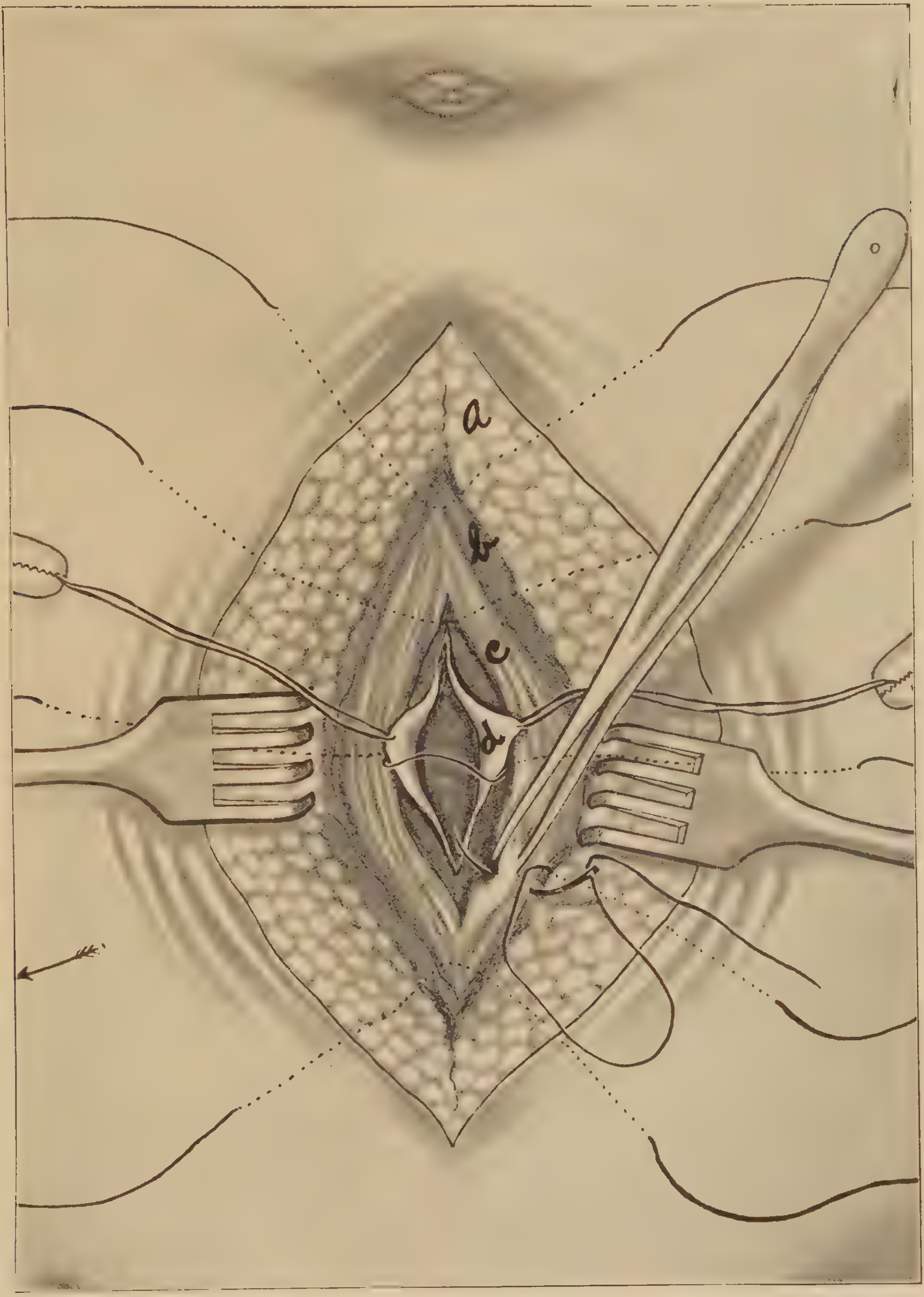


PLATE A.

Abdominal Incision through the Linea Alba between the Umbilicus and the Pubis.

The deep silkworm gut sutures being in place; (a) subcutaneous fat; (b) deep fascia composed of the aponeurosis of the internal and external oblique abdominal muscles; (c) the rectus abdominis muscle; (d) the peritoneum and transversalis fascia.

experienced this blunder will recognize the condition in future cases without the slightest difficulty.

Impacted fæces in the cæcum or in the sigmoid flexure have been misjudged for ovarian cyst. The free catharsis which is ordinarily employed in the preliminary treatment of these cases is sure to clear up the diagnosis.

DERMOID CYSTS OF THE OVARY.—The ovary may contain a certain amount of epiblastic tissue, such as skin with hair follicles or mucous membrane with embryonic teeth, or these may exist in connection with bone or connective tissue or glandular tissue. These structures may remain in a latent state for a long period of time, and may then begin to develop into what are technically termed dermoid cysts because of the hair and epithelium and teeth which they are likely to contain. Such cysts do not usually develop to any great size. They usually contain more or less hard tissue, such as bone or cartilage, and are consequently prone to give rise to pain on account of pressure. The differential diagnosis of these tumors in no way varies from that in ovarian cysts, and their treatment corresponds to the treatment of the latter; consequently it will not be necessary to give them a separate discussion.

OPERATION FOR THE REMOVAL OF OVARIAN CYSTS.—An incision is made in the median line, between the umbilicus and the pubis, from one to three inches in length. When the abdominal cavity has been opened the cyst will present as a bluish-white, shining surface. If the cyst is simple it will be regular and smooth on its surface; if it is multiple, one is likely to observe the lobes upon its external surface.

If the cyst is simple, it is best to withdraw the fluid from its cavity by means of a large-sized trocar, which is plunged into the cyst, an assistant pressing the abdominal walls gently against the surface of the cyst in order to prevent the escape of any fluid accidentally into the free abdominal cavity.

The fluid contained in these cysts may vary in color from a perfectly clear, limpid fluid to a yellow or dark-colored kind. The latter color is usually the result of a hæmorrhage into the cavity of the cyst and ordinarily occurs in cysts which have been subjected to some form of traumatism, such as a blow upon the abdomen.

Cysts which have previously been tapped frequently contain dark-colored fluid because of some hæmorrhage which has taken place into the cavity of the cyst through the wound made in tapping. Many cysts contain a thick, gelatinous fluid, which, however, is present usually only in case the lining of the cyst has undergone papillomatous degeneration. This substance may be so thick that it cannot be forced through a trocar and then the abdominal wound will have to be enlarged so that the tumor may be removed entire. This gelatinous fluid is supposed to contain cells which may give rise to the formation of secondary growths upon the peritoneal surfaces, consequently it is wise not to permit any of it to get into the free peritoneal cavity. The clear fluid contained in ovarian cysts is sterile and harmless, and its introduction into the peritoneal cavity does not result in any harm to the patient. After the contents has been removed to a sufficient extent to cause the cyst wall to become less tense the same may be grasped in forceps and drawn partly out through the abdominal wound, thus protecting the free peritoneal cavity against the introduction of any fluid. After the cyst has become entirely empty it may be withdrawn through the abdominal wound and its pedicle, consisting of the broad ligament and the Fallopian tube, may be transfixed and ligated with cat-gut or fine silk, and then the tumor may be cut away, care being taken to leave a sufficient amount of pedicle beyond the ligature to prevent slipping.

Care should be taken throughout the operation to cause as little unnecessary disturbance of the tissues as is possible.

The stump which is left after cutting away the tumor may be covered with peritoneum by means of a few cat-gut stitches. It is supposed that this will prevent the stump from forming adhesions with the intestines, but I believe that after an aseptic operation in which no traumatism is inflicted upon any of the surrounding tissues, such adhesions practically never occur even if the stump is not covered with peritoneum, while they do occur, notwithstanding this covering, provided the operation is septic or traumatism has been caused to the surrounding tissues.

If the cyst is composed of many small cysts the trocar may be carried from one to the other of these without being withdrawn

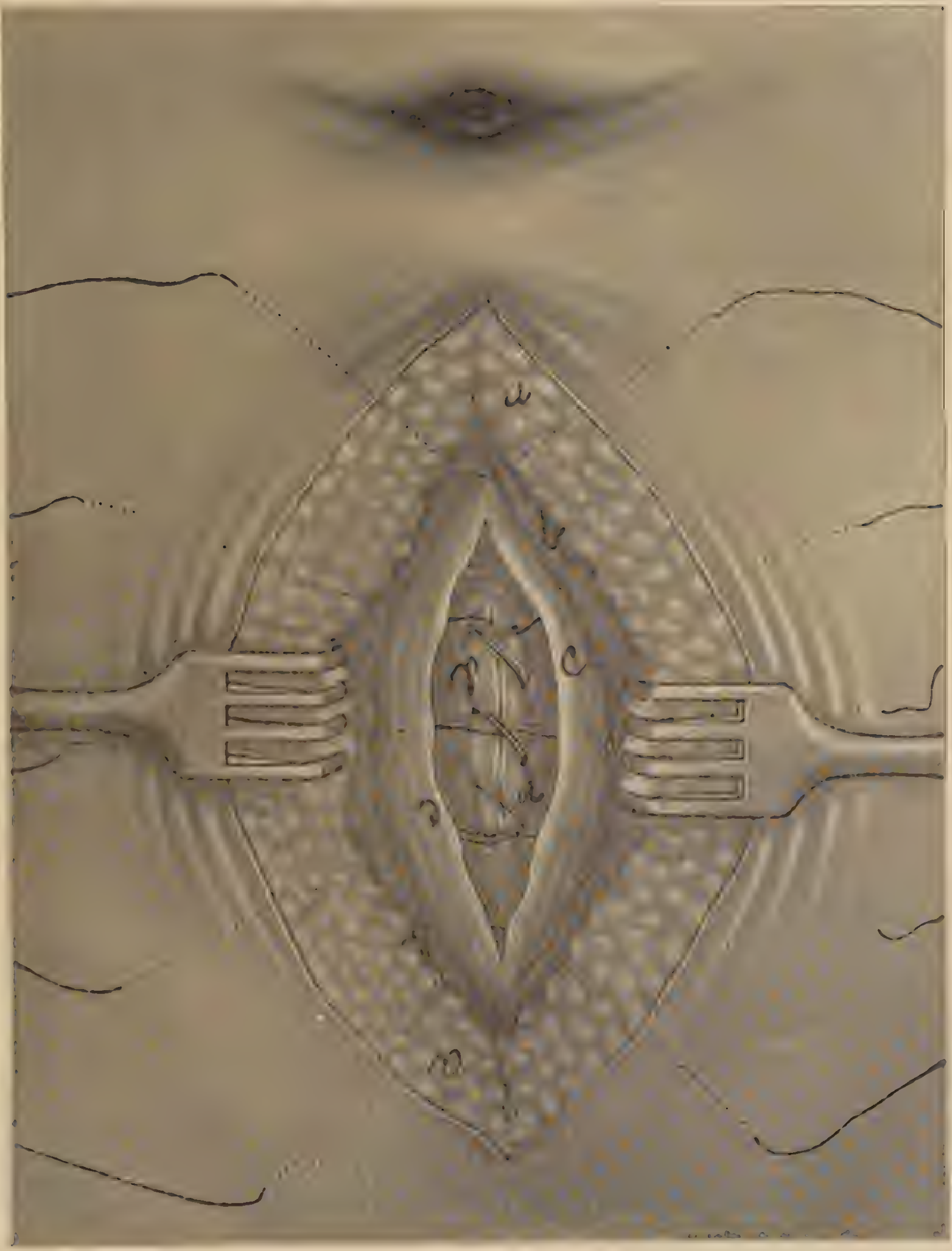


PLATE B.

Closure of Median Abdominal Incision.

Deep silkworm gut sutures extending through all the tissues down to the layer composed of the peritoneum and transversalis fascia are in place, but not tied. The peritoneum and transversalis fascia (d) have been untied by a continuous cat-gut suture, care being taken to pass these sutures over the silkworm gut sutures, in order that this layer may be drawn up against the lower surface of the recti muscles (c) when these sutures are tied. The rectus muscle (c) (c) on either side is to be united to its fellow with a few interrupted cat-gut sutures, and the deep fascia (b) (b) is to be united with a continuous cat-gut suture. The fat (a) (a) is brought together by the deep silkworm gut sutures.

from the original puncture, provided these cysts are large enough to make this practice feasible. If the cysts are too small it is better to enlarge the abdominal wound sufficiently to permit the removal of the tumor *in toto*. This should also be done in case of a papillomatous cyst, or a cyst containing fluid too thick to be forced out through the trocar. The pedicle of such cysts will be tied and the tumor removed in the manner described for the removal of simple cysts.

It is wise always to examine the opposite ovary, because it frequently happens that a second ovary contains a small cyst which if left undisturbed will enlarge and require a second abdominal section. In case the other ovary contains cysts of any size in a patient over forty years of age, it is wise to remove the entire ovary, together with the Fallopian tube, according to the method described. In a younger patient it is usually better to leave at least one-fourth or one-half of the ovary, making a conical excision of the diseased portion and closing the surface caused by this excision by means of fine cat-gut stitches. This will ensure the normal functions of the ovary, which is of great importance to a young patient.

It is well in these cases to examine the vermiform appendix, because remnants of disease may exist in this organ which would indicate its removal, which can be accomplished without danger to the patient according to the methods described in the chapter devoted to appendicitis.

The abdominal wound is closed in the usual manner, care being taken to unite corresponding layers.

It is my practice to split the inner fascia of the rectus abdominis muscle on each side and to unite the wound by inserting deep silk worm gut sutures grasping the layers down to the transversalis fascia, and then applying a separate row of continuous cat-gut sutures to the peritoneum and transversalis fascia, uniting the recti muscles with a few interrupted cat-gut sutures; then uniting the deep fascia, the aponeurosis of the external and internal oblique muscles, by means of a continuous cat-gut suture; then tying the silk worm gut sutures and applying a row of coaptation stitches to the skin, as illustrated in Plates A and B.

Complications.—The most common complication of ovarian cysts which affects the method of operation is the presence of adhesions. These may exist between the ovarian cyst and any one or more of the intra-abdominal organs. The most common adhesions are to the omentum, the anterior abdominal wall, and to the intestines. It does not matter to what portion an ovarian cyst may be adherent, it is always wise to expose the adhesion before an attempt is made to dispose of it, because although it may occasionally become necessary to lengthen the abdominal incision for this purpose, still this is of slight importance as compared to the benefit the patient derives from having this portion of the operation performed in plain sight. These adhesions frequently contain very large veins and their injury results in a great loss of blood, which is in itself undesirable and complicates the operation by covering the tissues so that they can be recognized with less ease. It is usually best to grasp long adhesions between two pairs of forceps, to cut between these, and to ligate the portion which is not connected with the uterus, and then drop the adhesion into the abdominal cavity. If the adhesion is to the intestine or other abdominal organ it is usually possible to select a point at which these tissues can readily be separated from each other, because there seems to be a union between the peritoneal surfaces which is not firm and can easily be disturbed if one succeeds in finding his point of cleavage. It is well to cover any abraded surface which is caused by this separation at once with peritoneum, to prevent future adhesions. This is especially important if the abraded surface is on the intestine. If this precaution is not observed a perforation might readily occur.

ABDOMINAL HYSTERECTOMY.

The removal of the uterus in itself is one of the simplest and safest abdominal operations in cases in which the condition for which the operation is performed is not connected with troublesome complications. The success of the operation depends upon the appreciation of a few exceedingly simple facts.

In this operation, as in every other abdominal operation, the first principle is, of course, the prevention of infection. This can be accomplished very easily, because the only source of infection connected with the operation itself is the uterine canal, and infection from this source can easily be avoided with care.

The next important condition which must be observed is the control of hæmorrhage. The uterus is supplied with blood by two small arteries on each side; the ovarian artery approaching it through the upper part of the broad ligament on each side, and the uterine artery approaching it from each side lower down. These vessels are ordinarily not larger than a good-sized knitting needle, and are consequently of no importance, provided they are recognized and carefully ligated. The method to be employed for the control of hæmorrhage will depend somewhat upon the choice of removal; with the uterus the Fallopian tubes and ovaries, which is always indicated in patients over forty years of age; or the removal of the uterus without the ovaries and tubes, which is indicated in younger patients in whom these organs in themselves are not diseased. If the ovaries and tubes are to be removed with the uterus, two pairs of long-jawed strong hæmostatic forceps should be applied to the broad ligament, side by side just externally to the ovary. They should extend parallel to each other with a space of one-half to three-fourths of an inch between them. The points of these forceps should extend to the body of the uterus. This should be done alike on both sides; then the tissue between these forceps is severed and the uterus, ovaries and tubes, grasped by the two pairs of forceps which are nearest together, can be elevated. The broad ligament is then severed further down toward the cervix, until the uterine canal is exposed. This is grasped by a separate pair of forceps on each side; then the peritoneal flap is cut from the anterior surface of the uterus and dissected downwards until a point opposite the internal os of the uterus is approached. The uterus is then cut away by means of a conical incision. This leaves the mucous membrane lining the cervix at the bottom of a conical space. It is necessary to exercise great care in cutting down upon the uterine arteries in order to approach them on each side of the body of the uterus after they have escaped from the broad ligaments. If this precaution is not taken there is danger of injuring the ureters, which pass through the broad ligament near this point.

If the operation is performed for the removal of a myomatous uterus great care must be taken in making the anterior peritoneal flap, because it frequently happens that the bladder is carried a considerable distance up over the anterior surface of such a uterus, and if care is not exercised in performing this part of the operation this organ is likely to be injured.

It is necessary to be careful in sponging the surface of the uterine stump not to carry any infectious material in the mucous membrane lining this stump to other portions of the abdominal cavity, thus causing infection. For the same reason it is well to eliminate this remnant of the canal from the operation by applying cat-gut stitches to unite the sides of the conical cavity which has been formed. It is this part of the operation which should be done with especial care, because most deaths occurring after abdominal hysterectomy are due to gangrene of the uterine stump, which results from a faulty application of the sutures. During the early practice of this operation surgeons were taught to fear hæmorrhage following hysterectomy, and consequently most of the older surgeons acquired the habit of tying the sutures applied to the stump so tightly as to make gangrene of the stump a very common occurrence. These sutures, and, in fact, all of the sutures uniting the surface in hysterectomy, should be tied just sufficiently firm to bring the surfaces together, but not so firm as to cause suture necrosis. (The observation of this precaution in my own practice has reduced the mortality in abdominal hysterectomy to almost nothing.)

The broad ligament is now transfixed with a cat-gut or fine silk stitch and ligated on each side, care being taken to apply this ligature so that there is no possibility of slipping. Then a stitch is placed around the uterine artery on each side and tied only just firmly enough to prevent hæmorrhage. Then it is my practice to apply a separate ligature to the end of the uterine artery grasped by the forceps on each side. This does not seem necessary, but I continue to do this as a result of the old superstition concerning the likelihood of hæmorrhage.

The entire wound should now be sutured from side to side, so that every portion is covered with peritoneum. This completes the very simple operation; the four points to be borne in mind being:

1. The avoidance of infection.
2. The protection of the ureters and bladder.
3. The careful control of hæmorrhage.
4. (And most important of all) The prevention of gangrene of the stump by avoiding too firm tying of sutures.

In case it is desirable not to remove the ovaries and tubes the operation is performed in the same manner, with the exception that the control forceps are applied to the broad ligament directly along the side of the uterus, leaving the ovaries and tubes to the outer side of the outer forceps.

SPLITTING OF THE UTERUS.

In case it is difficult or impossible to apply the forceps to the broad ligaments because of the presence of tumors or adhesions, or both, conditions which occur occasionally, the operation can be greatly facilitated by inserting a strong pair of tenaculum forceps in each horn of the uterus, having an assistant make quite firm extension upon these forceps, and then splitting the uterus longitudinally down to a point opposite the internal os. The tension upon the forceps in the horns of the uterus prevents hæmorrhage from the cut surfaces.

Of course, the same precaution must be employed against injuring the bladder on the anterior surface of the uterus, if it extends above the normal position, that was mentioned in the operation just described.

When the internal os has been reached a slight lateral incision is made on one side to a point at which the uterine artery is exposed. The broad ligament, together with the uterine artery, is then grasped at this point from below by means of strong forceps, and the uterus is cut away to the inner side of these forceps. Another pair of tenaculum forceps is inserted in the lower end of the half of the uterus under consideration, and tension is made upon this as well as upon the tenaculum forceps in the horn of the uterus on this side. Care must be taken not to relax upon the other pair of tenaculum forceps for fear of causing a hæmorrhage upon the half of the uterus not immediately under consideration.

After the lower end of the uterus has been loosened it is an easy matter to grasp the remaining vessels in the broad ligament by means of clamps and remove the half of the uterus together with the tumor it may contain. In case the Fallopian tube or ovary are also in a pathological condition they can readily be removed with this portion of the uterus. The same steps are taken upon the opposite side.

After the uterus has been removed the vessels are ligated precisely as they were in the operation which has just been described. The stump of the uterus is disposed of in the same manner, and, in fact, the remainder of the operation is in no way different from that which has just been outlined.

In case there are adhesions between the uterus or the ovaries and tubes and some other abdominal organs, these must be loosened with great care and all bleeding points must be carefully ligated and all abraded surfaces carefully covered with peritoneum by means of Lembert sutures. Especial pains must be taken in covering large abrasions upon the small intestine, due to the necessity of loosening extensive adhesions. Whenever possible it is wise to make transverse closures of these abraded surfaces for fear of causing a narrowing of the small intestine, which, however, is not very likely to occur because of the elasticity of the peritoneum. If any abraded surface in the pelvis cannot be covered with peritoneum it is wise to place the sigmoid flexure upon this surface, and, if necessary, to fasten it in place by a few fine cat-gut stitches. The abdominal wound is now closed in the usual manner.

MYOMECTOMY.

Generally speaking it is proper to make a hysterectomy for any cases of fibroid tumors of the uterus in patients of forty years of age or over, in whom this operation seems to require the least amount of traumatism. In younger patients, whenever possible, the excision of fibroid tumors of the uterus without the removal of the uterus itself should be practiced, even though the operation be connected with greater difficulty and with greater traumatism. It is surprising how easily fibroid tumors can be enucleated from the uterus even when deeply-seated, and if traction is made upon the organ this operation is not connected with much hæmorrhage.

If the tumor is in the superior portion of the uterus the transverse incision should be made and the tumor enucleated. Here again the same principle should be applied that has been mentioned in connection with the closure of the stump in abdominal hysterectomy. The space from which the tumor has been removed should be closed by means of fine cat-gut sutures which are tied just firmly enough to bring the surfaces together, but not sufficiently firm to cause pressure necrosis. As many rows of these sutures as are required to close the entire cavity should be employed; their number is of no especial importance.

When the outer wound in the surface of the uterus is reached it is important to extend the suturing a little beyond each end of the wound because this will overcome the troublesome oozing which frequently occurs from the very ends of the incision in case this precaution is not taken.

In case the uterine cavity is opened during the operation, it should be carefully sponged or curetted and a folded piece of rubber protective tissue should be passed through the uterine canal into the vagina for the purpose of drainage. In this case the first row of sutures should pass down to, but not through, the mucous membrane, for fear of infecting the deeper tissues in the uterus. The danger from infection from the uterine canal in these cases has been greatly over-estimated, and I believe that in cases in which there has apparently been such an infection it has resulted from the fact that the sutures which were applied for the purpose of protecting the wound in the uterus were tied too firmly and gave rise to pressure necrosis.

PYOSALPINX.

The case before us is typical of the disease under consideration. The patient is twenty-three years of age, married fourteen months, and gives the following history:

She suffered from mild attacks of all the contagious diseases of childhood but experienced no unfavorable after-effects. Menstruation began at the age of fourteen, was regular and painless, and the patient's health was excellent until a short time after her marriage, when she suddenly experienced severe pain in the lower portion of her abdomen. She had previously observed the presence of leucorrhœa and a mild attack of cystitis, to which she gave no attention. After remaining quiet for two days, taking hot douches and a cathartic and applying heat to the abdomen, the pain subsided and the patient was able to be up and about, but since that time she has never felt perfectly strong and well. Her next menstrual period was characterized by severe pain, which lasted for two days, leaving her condition slightly worse than it had been before. She felt feverish during the entire period of menstruation. She has continually become worse, suffering from severe pain every few days, and during each successive menstrual period having an attack more severe than that of the preceding period. During the past two months she has scarcely recovered from the effects of one attack before experiencing the next. At the time of her marriage she was strong and vigorous and in every way in excellent health.

Present Condition.—Anæmic woman, somewhat emaciated, having lost twenty pounds during the past year. Her appearance indicates the fact that she has suffered severely. Her skin is rough and her color is bad.

Physical Examination.—All organs, with the exception of the pelvic organs, are normal. A pelvic examination reveals the presence of severe induration throughout the pelvic floor. In the left broad ligament there is a mass as large as a man's fist. The right broad ligament contains a mass about one-half as large. The cervix of the uterus is enlarged to twice the normal size; it is hard and œdematous.

Bimanual examination seems to reveal a slight amount of fluctuation in the left side.

Upon rectal examination there is found an indurated area opposite the cul-de-sac of Douglas, which renders this portion of the bowel quite rigid. The patient complains severely of pain during both the rectal and vaginal examinations. Upon bimanual examination the abdominal muscles contract to protect the inflamed tissues underneath.

Diagnosis.—The history as well as the physical investigation indicate the presence of an infection affecting the uterus, the Fallopian tubes and the pelvic peritoneum. This is undoubtedly gonorrhœal in origin because of the time of its occurrence, the presence of leucorrhœa and cystitis, and the physical conditions present.

Upon inquiry we have determined that the husband suffered from an acute specific urethritis two years ago, from which he recovered after four months, but that he occasionally noticed a slight amount of secretion after some indiscretion in diet or some over-exertion. About one week after his marriage he noticed a slight occurrence of this condition, which, however, disappeared after a few days.

It is likely that the infection advanced slowly through the uterine canal and through the Fallopian tubes and that the fimbriated extremities of the latter organs have become adherent to the ovaries and have thus become occluded, and that pus has accumulated in the distended Fallopian tubes.

The patient has received local treatment almost constantly since the beginning of her attack, by means of hot douches, the application of tincture of iodine and nitrate of silver to the uterine canal and the cervix, and by the application of vaginal pads saturated with glycerine and ichthyol; but none of these remedies has been of any permanent benefit to the patient.

Treatment.—During the early part of the disease it is best to make use of non-surgical treatment:

1st. Because many severe infections of this form recover completely with this treatment and later go through normal pregnancies provided reinfection is avoided.

2nd. Because the surgical treatment is exceedingly dangerous during the early portion of the disease, while it is quite safe later on.

3rd. The patient is not exposed to any risk because of the postponement of the operation, provided the internal treatment is carried out properly and rest in bed is insisted upon.

The infection affects a relatively small and a safe portion of the peritoneal cavity,—the pelvic portion. If it is confined to this portion the worst possible consequence will be a circumscribed abscess which from its location may either become absorbed, or it may remain encapsulated, or it may rupture into the rectum, the bladder or the vagina. If undisturbed the rupture will practically always take place into the rectum if it takes place at all, which is, of course, the most favorable direction.

Anatomically the arrangement is most perfect for the development of circumscribed abscesses.

If the infection advances slowly the fimbriated extremities of the Fallopian tubes will become adherent to the ovaries or to the floor of the pelvis, and then the infection will be confined to one or to both tubes. It may remain in this position, dilating the tubes until they attain a considerable size, as on one side in the case before us, or they may become distended beyond their capacity and may rupture and infect the surrounding tissues. In this case adhesions have usually formed before the rupture takes place. These most commonly exist between the tube and the omentum or cæcum, or sigmoid flexure of the colon, or some loop of the small intestines, or several or all of these. It is very seldom that an abscess of this kind ruptures into the free peritoneal cavity except as the result of a severe strain or a traumatism.

With a circumscribed infection the conditions are very similar to those described with the infection due to perforative or gangrenous appendicitis, and consequently the early treatment should have the same end in view as has the non-surgical treatment of acute appendicitis, namely, the confinement of the infection to the vicinity of the tissues originally involved.

The physiological elimination of the infected area in the condition under consideration is almost perfect because the omentum will apply itself to the surface of the tube, the sigmoid flexure will apply itself above and to the left, and the cæcum and appendix to the right. If there is still a small area left it will be occupied by some portion of the small intestine, and as all of the tissues which have been mentioned, except the small intestine, are relatively fixed, the infection is likely to remain circumscribed unless it is carried by the small intestine from its original area to other portions of the peritoneal cavity. This can be prevented by inhibiting peristaltic motion, which, as has been shown before, can be accomplished by the prohibition of all food and cathartics by mouth and, if necessary, by the addition of the use of opium. If the stomach contains food or mucus this should be removed by gastric lavage.

It should be remembered that in case neither food nor cathartics are given by mouth, opiates may be administered either by enemata or hypodermatically with safety to the patient. Large hot vaginal douches frequently administered are a source of great comfort and are of undoubted benefit to these patients. The douches should be given as hot as they can be borne. The patient may be nourished by the use of nutritive enemata, which have been described herein before.

There is an important advantage in first treating all cases of this class by the method which has just been described, aside from the advantages which were mentioned early in the consideration of this subject, owing to the fact that the virulence of the micro-organisms causing this infection will be very greatly reduced if the infection is compelled to remain circumscribed; in other words, we make use of the principle of rest in the treatment of this infectious disease the same as we do in the treatment of infectious conditions in other parts of the body. If this state of rest is continued for a considerable time the infection becomes so thoroughly circumscribed that the pus itself will ultimately destroy all of the micro-organisms which it contains, and when examined will be found perfectly sterile.

An operation performed after the pus has acquired this condition of sterility is of course relatively very much safer than if it were performed while the pus is still full of living pathogenic micro-organisms. It is likely that in many cases in which it was supposed that a re-infection took place from the pus which existed in a circumscribed abscess there was in fact a re-infection through the uterus. The occurrence of such re-infection should, of course, be carefully guarded against.

Although a large majority of cases in which there is but a single infection of the Fallopian tubes will recover fully, or to such an extent that it is impossible to determine the presence of any pathological condition by physical examination, there will always be many cases which have either had repeated infections or which have not recovered fully from a single infection, and these cases can be relieved permanently only by a surgical operation.

Operative Treatment.—The operative treatment of these cases must be planned so that none of the uninfected portions of the abdominal cavity become infected during operation, so that all of the disease is removed, and so that there will be no serious secondary conditions developed as the result of the operation.

In order to prevent the infection of portions of the peritoneal cavity not involved, it is wise to make the abdominal incision sufficiently long to enable the surgeon to perform the necessary manipulations in sight. In severe cases it is usually best to make the incision from a point an inch below the umbilicus to the pubis. In mild cases it may be considerably shorter. In unusually severe cases it is often wise to carry the incision around the umbilicus to the left and a convenient distance above the same.

The operation can be greatly facilitated by placing the patient in the Trendelenburg position, by elevating the foot of the table so that the patient's body rests at an angle of about forty degrees. This causes the intestines to withdraw into the upper portions of the peritoneal cavity, or if they do not take this position by their own weight, the object can be accomplished by pushing the intestine upwards by means of a large, moist, sterile, gauze compress. The intestines should be carefully tamponed away from the seat of the operation because in this way they will not be exposed to infection during the operation, nor to the irritating influence of the air.

The entire operation can now be performed without manipulating anything outside of the pelvis, and this portion of the peritoneal cavity is the least sensitive and its manipulation is accompanied by the slightest amount of shock. This is a fact of very great importance, because if borne in mind the patient's suffering can be reduced greatly and her chances of recovery can be much improved. The further steps of the operation will depend upon the extent of the infection and upon the parts involved, as well as upon the number and firmness of adhesions.

If the Fallopian tubes alone are concerned, forming sausage-shaped bags of pus, the operation will be identical with that which has been described for the removal of ovarian cysts. The broad ligament will be ligated below the mass and a second ligature will be placed around the Fallopian tube near the uterus and the mass will be cut away, leaving a sufficient amount of tissue beyond the ligature to prevent slipping. It is well to place a pair of forceps upon the Fallopian tube beyond the point at which this is cut away in order to prevent any leakage from the cut.

Many authorities prefer to excise a conical portion of the uterus together with the end of the Fallopian tube and to close this by means of sutures. Theoretically this method seems preferable, but practically there is no difference between the two methods.

If the adhesions are extensive it is often much easier to place two pairs of forceps upon the Fallopian tube at its point of entrance into the uterus. The forceps should be placed parallel to each other; then the tube is cut away between these forceps, which opens the space between the upper and lower fold of the broad ligament. By applying forceps successively upon the broad ligament from within outward and cutting between these forceps it is usually possible to enucleate the pus tube without the danger of rupturing it. In many cases the uterus itself seems so thoroughly infected that it may be best to remove this organ together with the infected tubes and ovaries. In this case the operation described for the removal of the uterus containing fibroid tumors may be employed, great care being taken, of course, to prevent a rupture of the abscess. It is in such cases that the method of splitting the uterus longitudinally is often of especially great value. The remaining steps of the operation are the same as those which have been already pointed out.

Here again it is particularly important to exercise care in inspecting the surfaces of the small intestines which have been adherent to the ovaries or tubes, or to the infected uterus, because in loosening these adhesions it sometimes happens that a loop of intestine is perforated, and unless the perforation is carefully closed and the surface covered with peritoneum a fæcal fistula is apt to occur and the intestinal contents may cause an infection of the intestine, giving rise to a septic peritonitis, of which the patient may die.

After all of the diseased tissue has been removed it is wise to cover the abraded surfaces as far as possible with portions of the surrounding healthy peritoneum. If this cannot be done the sigmoid flexure should be brought down and placed across this portion of the pelvis, and if there is doubt about this remaining in position it is well to fasten it by means of a few cat-gut stitches. The omentum should also be brought down to this surface. If the operation has been accomplished without causing a rupture of the abscess the surface should be sponged perfectly dry, the gauze tampons which have been placed for the protection of the surrounding intestines should be removed, and it is well to bring the omentum down from the small intestines so that these do not come in contact with the field of operation because of the danger of distribution of infectious material by peristaltic motion.

If there is any doubt about the aseptic condition of the field of operation it is always best to apply some form of drainage. Personally I have found a curved glass drainage tube, half an inch in diameter, placed within a strand of iodoform gauze behind the stump of the uterus in the cul-de-sac of Douglas, and permitted to protrude through the lower angle of the wound, most satisfactory. This tube can usually be removed the second day after the operation and the gauze surrounding it two days later, permitting the abdominal wound to close perfectly without danger of the formation of ventral hernia.

If there has been a severe infection it may be necessary to leave the tube in place for a longer period of time. The abdominal wound is closed down to the drainage tube in the usual manner.

These points then are of marked importance:

1st. The banking away of the non-infected contents of the abdominal cavity.

2nd. The manipulation of only the structures contained in the pelvis.

3rd. The care to prevent the perforation of the intestine.

4th. The covering of all raw surfaces either with peritoneum or with the sigmoid flexure or omentum, or both.

5th. Drainage in cases in which the surgeon is not positive that the field is aseptic.

AFTER TREATMENT.—If these patients bear the administration of small, frequently-repeated drinks of hot water well, they should be given. If this causes nausea or vomiting it is best simply to have the patient's mouth rinsed with hot or cold water and not to give anything by mouth for two days. At the end of such time beef-tea or one of the various concentrated predigested foods may be given every two hours in small doses. After two days these patients usually bear hot water well. Rectal feeding is generally somewhat dangerous in these cases because of the congestion which follows an extensive operation in the pelvis. In these cases the alimentary canal should be perfectly empty before the operation, as a result of the administration of two ounces of castor oil on the previous day. If no further food is given by mouth morphine may safely be administered, hypodermatically if necessary, to quiet the pain.

VAGINAL HYSTERECTOMY.—If for any reason it seems objectionable to perform an abdominal section in these cases, the uterus and ovaries and tubes may be removed by the vaginal route, which will be described later on. The objection to this route lies in the fact that the conditions cannot be so perfectly determined and one frequently removes organs which might be saved if the abdominal operation were chosen. It also happens frequently that a diseased vermiform appendix is overlooked.

In the criminal classes I believe that this operation is indicated much more commonly than in practice among other patients, because in these cases re-infection is almost certain to occur if the uterus is not removed together with the other infected organs.

TUBERCULAR PERITONITIS.

History.—The patient before us is a married woman thirty-two years of age, giving the following history:

Her father died of pulmonary tuberculosis at the age of fifty. One sister died of the same cause at the age of thirty. Another sister is suffering from the same disease at the present time. The patient suffered from measles as a child but otherwise had good health. Her menstruation began at the age of fifteen and was regular but somewhat painful. She was married at twenty-two; has had five normal pregnancies. She has suffered from constipation during the past ten years. The abdomen has been distended for several years and she has suffered from eructations of gas. About four months ago fluid was first discovered in the abdominal cavity. She was then put to bed and received internal treatment, but the accumulation of fluid in the peritoneal cavity has constantly increased. In the meantime she has lost ten pounds in weight. She has occasional pains in the left side of the abdomen, lasting a few hours at a time. The abdomen is enlarged to the size of a six months' pregnancy, but is flattened and there is a prominence of the umbilicus.

Present Condition.—The patient is sufficiently nourished; her tongue is clean; the appetite fair; the bowels constipated; the heart, lungs, liver and kidneys normal; her temperature is normal; her pulse is 80, regular and fairly strong; the abdomen is distended and tympanitic. A rather hard mass is felt in the right side of the abdomen opposite, and a little below, the umbilicus; slightly movable, but does not move with respirations. Her right kidney is movable. There is dullness upon percussion, with the exception of a small area over the most prominent part of the abdomen. The area of dullness changes with a change in her position. Upon vaginal examination the uterus is found bound down by a solid mass in the pelvis.

This history, together with the physical examination, would indicate the presence of a tubercular peritonitis with fluid in the free peritoneal cavity. The fact that the heart, liver and kidneys are normal would indicate that the fluid contained in the peritoneal cavity must be the result of a local irritation. This might be due to the presence of a papilloma originating from the ovaries, but that would scarcely account for the mass in the upper portion of the peritoneal cavity which is probably the result of adhesions between the omentum and the intestines, due to abdominal peritonitis. It is not difficult in this case to differentiate between this condition and the presence of an ovarian cyst, because the abdominal cavity is not so thoroughly distended as to make all portions dull upon percussion, nor are the small intestines so completely agglutinated by tubercular peritonitis that they will be held away from the circumscribed accumulation of ascitic fluid, making a resonant area above or to the side. The tubercular family history would make a tubercular infection especially likely, although many of these cases obtain their infection from food.

TREATMENT.—This patient has been under constant treatment during the past four months by a careful and competent physician. The treatment consisted of hygienic measures, of rest in bed, of intestinal antiseptics, and the patient has been given good, wholesome food, care being exercised that the milk, and all the other food which might possibly contain tubercle bacilli, was carefully sterilized before being given to the patient.

Before going into the subject of the treatment of tubercular peritonitis carefully we will dispose of the case before us by simply making an incision three inches in length in the linea alba below the umbilicus. This at once permits a large quantity of thin, slightly-yellowish fluid to escape, leaving the peritoneal cavity studded with tubercles throughout, the intestines and omentum being somewhat adherent in the outer portion of the peritoneal cavity, the cæcum and appendix to the right being covered with the same small tubercles, the uterus, ovaries and tubes, and the sigmoid flexure, forming a mass in the pelvis also covered with tubercles. The peritoneum is one-eighth of an inch in thickness, somewhat purplish in color and completely studded with tubercles.

After carefully sponging away all of the free fluid with moist aseptic gauze pads, exercising great care not to cause any abrasions by the manipulations, the abdominal wound is closed. It is doubtful whether, in a patient like the one before us, it is better to close the abdominal cavity at once or to insert a drainage tube surrounded with iodoform gauze, as previously described. In case the latter method is chosen the tube and gauze should be removed as soon as the drainage has ceased.

At the present moment the treatment of tubercular peritonitis seems to drift back into the hands of the practitioner of internal medicine, after having been virtually considered a surgical disease. Until very recently, for a period of more than ten years, the surgeons were generally willing to undertake the surgical treatment, and their immediate results were usually so favorable that it seemed as though the surgical treatment had been permanently established. Recent literature, however, indicates that surgeons with a considerable experience report approximately fifty per cent. of recoveries extending over at least two years. Surgeons who report fewer cases show a large percentage of recoveries, but it is scarcely fair to count these cases, because it is likely that in this group a greater proportion of favorable than unfavorable instances are reported, *i. e.*, of all surgeons who have operated upon only one or two of these cases those who have been fortunate in their results will feel inclined to encourage others, while those who have been unfortunate abandon the subject as unworthy of special attention.

Drainage, irrigation and medication of the abdominal cavity are not only considered useless by many authors of great experience, but actually undesirable, and the simpler the operation performed the better will be the result according to these authorities. This idea is illustrated in many of the instances in which the cases reported were found to suffer from tubercular peritonitis when the operation had been performed with the expectation of removing an ovarian cyst, the fluid being drained and the abdominal wound closed. In many such cases the condition appeared absolutely hopeless and it seemed to be foolish to do anything at all.

A very large number of similar cases have been reported by different authors and the literature contains many interesting compilations of cases which appear to show great benefit from abdominal section. During the past few years it has been shown that the results in cases treated for tubercular peritonitis in the medical departments of many of the great hospitals were about the same as those in the surgical clinics. If these observations are correct it would appear as though these patients should be placed under medical rather than surgical treatment, because the latter is of course connected with a greater amount of pain and a slight amount of danger from the operation itself. That many cases have recovered permanently and completely after abdominal section there can be no doubt, because this has been positively proven by autopsies upon patients who died from other causes, when they were found completely cured, tuberculosis having been demonstrated at the operation and the diagnosis confirmed microscopically.

Although the diagnosis cannot be made so positively in the cases which have been treated without operation, it seems clear that many undoubted cases have been cured by medical and hygienic measures.

An analysis of the various papers on both sides of this controversy shows, it seems to me, that the authors were not discussing the same class of patients.

The medical practitioners seem to deal with these cases earlier in the attack, while the condition is still more or less acute; on the other hand, the surgeons meet with the cases in the chronic condition after those which are curable by medical treatment have been eliminated. In other words, the medical treatment is virtually applied to all cases at first, and if persisted in will result in approximately fifty per cent. of cures, of which about one-half have a recurrence after a number of years. If the medical treatment in the remaining fifty per cent. of cases is continued after the time when it becomes apparent that it has no beneficial effect, then the chances are that those cases will go from bad to worse until they succumb. If, however, the surgical treatment is employed in these cases in which the medical treatment has proven to be of no benefit, then all of the cases of this group which recover permanently, as well as those which are temporarily improved, constitute an absolute gain because they reduce the failures from the internal treatment and increase the favorable results by their entire number.

It is interesting to note that all authors who favor the medical treatment of these cases insist upon beginning during the early part of the attack, in fact, as soon as the diagnosis has been made. They all advise primarily hygienic measures; rest in bed, intestinal antiseptics, some form of creosote, and some form of iodine to be given internally; also sterilized, concentrated food.

Many external applications have been advised, especially ointments containing some form of iodide or mercury. Many of those advising surgical treatment combine hygienic treatment with it and advise that this be continued indefinitely after the recovery from the operation.

Of those who advise operative treatment several surgeons of large experience caution against operation too early in the attack, because recurrence is more likely in case the operation is performed before the tubercles are fully developed. It has been demonstrated experimentally that this is a wise precaution to take, because new tubercles developed in animals after an early laparotomy, while in other similar animals a later operation resulted in a permanent cure. The cure is attributed to the secretion of an anti-toxin which, it is claimed, is not produced before the tubercles have been fully developed.

Many experiments have been made to determine the manner in which the cure is accomplished. It has been demonstrated in animals, upon which an artificial tubercular peritonitis had been produced, that the abdominal section is followed by a severe hyperæmia which lasts longer than in cases not suffering from tubercular peritonitis. This is considered the curative element which is attributed to the action of the air upon the diseased peritoneum, as it does not occur when the animals are kept submerged in normal salt solution during the operation. Other authors have attributed the curative effect of abdominal section to an anti-toxin produced from the dead bacilli, which will be absorbed. These conclusions are also based upon experimental research. It has been found that the anti-toxic effect of the ascitic fluid increases with its age.

I have had occasion to review my personal experience in the treatment of tubercular peritonitis by laparotomy. The accompanying table contains all the cases of tubercular peritonitis upon which I have performed abdominal section at the Augustana Hospital during the past eleven years, with the hope of obtaining a permanent cure. This group contains thirty-two cases, varying in age from nine to fifty-six years:

From the age of 8 to 19 there were 11 cases.
From the age of 19 to 29 there were 9 cases.
From the age of 29 to 39 there were 6 cases.
From the age of 39 to 49 there were 3 cases.

Above the age of 49 there were 3 cases (55, 56, 58 years of age).

There were twenty-four female and eight male patients.

But one patient, Case 12, died as a direct result of the operation, on the seventh day, from exhaustion. The appendix in this case was tuberculous and was deeply imbedded between the cæcum, the ileum and the omentum. Its removal necessitated a very tedious dissection. It seemed to me at that time that it would not be good surgery to leave this infected organ in the abdominal cavity. The patient was fifty-five years of age and her resistance was not good. She never reacted from the operation. I am now positive that this was bad surgery, because in other similar cases in which I simply removed the fluid and exposed the peritoneum to the air and closed the abdominal wall or drained the cavity for a week or longer, the patients have usually done surprisingly well.

In this series there are several such cases, Nos. 2, 8, 10, 15, 16, 18, 19, 23, 27, 30, 31, 32 were in a similar and, in fact, most of them in a worse, condition. Several of them were so advanced that nothing was done after the abdomen was opened except to empty the fluid, because it seemed absolutely useless, the cases being apparently in a hopeless condition. Nevertheless they recovered from the operation and many of them have been perfectly well for many years, as will be seen from the table.

I was impressed most thoroughly with this fact by two cases, whose histories I will give in abstract to illustrate the extent to which recovery may occur in instances in which the pathological condition at the time of the operation seemed to preclude the possibility of a complete recovery. The first of these cases does not belong to the group in the accompanying table, because she was not operated in this hospital. I simply quote the case because it

Hospital Number.	No.	Name.	Age.	Sex.	Admission.	Discharge.	Diagnosis.	Treatment.	Result,
723	1	H. M.	17	F.	May 22, '91	June 7, '91	Ascitic form, peritoneum greatly thickened. Small tubercles over entire peritoneum, intestines, omentum, tubes and uterus.	Laparatomy. Tubular drainage ten days nothing removed. Eight quarts of fluid.	Recovered. May 13, 1902, eleven years since the operation has been perfectly well with exception of a few weeks illness.
770	2	L. S.	58	F. M.	Aug. 22, '91	Sep. 12, '91	Tuberculous Peritonitis. Peritoneum covered with small tubercles Ovaries and tubes adherent in pelvis in tubercular mass.	Considerable quantity of fluid removed not measured.	Recovered.
866	3	I. C.	18	F.	Apr. 5, '92	Apr. 28, '92	Tuberculous Peritonitis. Ascitic form entire peritoneum covered with tubercles. Parietal peritoneum greatly thickened.	Laparotomy and drainage. Drainage remained one week. Removed twenty-five pints of fluid.	Recovered.
976	4	H. S.	32	F.	Oct. 10, '92	Nov. 30, '92	Tuberculous Peritonitis. Diffuse with ascitis and caseous masses and enlarged mesenteric lymph glands.	Laparotomy. Removed large tubercular mass surrounding both ovaries and tubes.	Recovered.
978	5	L. B.	39	F.	Oct. 11, '92	Dec. 8, '92	Tuberculous Peritonitis.	Laparotomy. Drainage. Drained for one week. Removed tubercular ovaries.	Recovered.
2362	6	A. A.	16	F.	Sept. 8, '95	Oct. 27 '95	Tuberculous Peritonitis. Both ovaries and tubes completely covered with tubercles.	Laparotomy draining cavity. Abdominal wound closed. Both ovaries and tubes removed.	Recovered. May 17, 1902, in six and one-half years after operation. Is well and has been ever since leaving hospital but has small fistula.
2426	7	E. L.	23	F.	Oct. 6, '95	Nov. 22, '95	Tuberculous Peritonitis diffuse with ascitis, complicated with tubercular ovarian cyst as large as a fist.	Laparotomy. Excision of cyst. Drainage continued for two weeks.	Recovered.
2844	8	N. H.	15	F.	May 1 '96	June 12, '96	Tuberculous Peritonitis. Intestines, omentum, all pelvic organs in one continuous mass of adhesions, thickly covered with tubercles. Parietal peritoneum greatly thickened and one mass of tubercles. A slight amount, about two quarts of fluid.	Laparotomy. Drainage continued for two weeks.	Recovered. May 14, 1902. Six years after operation is in perfect health weighs 120 lbs. a gain of 58 lbs. Was almost a skeleton at time of operation and was perfectly helpless.
3263	9	J. A.	37	F. M.	Oct. 4, '96	Oct. 26, '96	Tuberculous Peritonitis.	Laparotomy. Drainage.	Recovered. Died two and one-half years after operation from recurrence.
3795	10	C. A.	10	M.	May 10, '97	June 26, '97	Tuberculosis of entire peritoneum. Appendix and mesenteric glands tuberculous. A small amount of ascitic fluid.	Laparotomy. Excision appendix and tubercular mesenteric glands.	Recovered.
3898	11	E. H.	25	F.	June 18, '97	Aug. 13, '97	Tuberculous appendicitis and diffuse peritonitis with ascitis	Laparotomy. Excision of appendix. Drainage for one week.	Recovered. May 16, 1902. Five years since operation. Is in excellent health but lives in Alabama in better climate.
5248	12	F S.	55	F	Aug 14, '98	Aug. 20, '98	Tuberculous Peritonitis and Appendicitis with slight amount of ascitis.	Laparotomy. Excised appendix and drained for one week.	Died as result of operation from exhaustion on seventh day.
6474	13	S. P.	21	M.	July 30, '99	Sept. 15, '99	Tuberculous Peritonitis Large amount of ascitis.	Laparotomy and drainage for two weeks.	Recovered. May 17, 1902, nearly three years after operation patient examined and found perfectly well.
6777	14	J. A.	22	F.	Oct. 9, '99	Nov. 5, '99	Tuberculous Peritonitis complicated with tertiary syphilis	Laparatomy and drainage for two weeks.	Died four weeks after operation from exhaustion, the disease progressing.
6963	15	J. R.	9	M.	Dec. 3, '99	Jan. 7, '00	Traumatic Tuberculosis. Attack very violent, following a fall upon abdomen upon the edge of a curb stone during apparently good health. The entire peritoneum was thickly covered with tubercles, the abdominal cavity contained ten pints of fluid.	Laparotomy and drainage for ten days.	Recovered. Patient is perfectly well and strong, May 15, 1902, two and one-half years after operation.
7105	16	L. G.	22	F.	Jan. 14, '00	Feb. 11, '00	Diffuse Tuberculous Peritonitis. Contained fifteen pints of fluid. Ovaries, tubes and sigmoid in a mass of tubercular tissue.	Laparotomy and drainage for one week.	May 15, 1902 two years after operation, perfectly well since returning from hospital.

7269	17	W. M.	27	F. M.	Feb. 22, '00	Mar. 31, '00	Tuberculous Peritonitis. Ascitic form.	Laparotomy, drainage for one week.	Recovered.
7399	18	J. H.	27	F. M.	Mar. 21, '00	June 11, '00	Tuberculous Peritonitis. Intestines and omentum in a mass of tuberculous tissue. Mesenteric glands tubercular, pelvic organs adherent in a mass of tuberculous tissue, very slight amount of fluid.	Laparotomy and drainage for one week.	Recovered. May 14, 1902. Is well and able to do all the house-work.
7491	19	E. D.	26	F. M.	Apr. 16, '00	June 7, '00	Tuberculous Peritonitis. Fallopian tubes and ovaries imbedded in mass of tuberculous tissue in pelvis. Peritoneum universally thickened and covered with tubercles.	Laparotomy and drainage two weeks. Moderate amount of fluid.	Recovered.
7569	20	O. B.	19	M.	Apr. 30, '00	June 9, '00	Tuberculous Peritonitis. Mesenteric glands generally involved. Very slight amount of fluid.	Laparotomy. Sponged out cavity with hot sponges wrung out of normal salt solution. No drainage.	Recovered.
8000	21	G. S.	10	F.	Aug. 21, '00	Sept. 21 '00	Tuberculous Peritonitis. Diffuse miliary form with great amount of ascitic fluid, not measured.	Laparotomy. Removed fluid. Wound closed.	Recovered. Died from diffuse miliary tuberculosis Dec. 20, 1900, four months after operation.
8130	22	C. H.	43	M. M.	Sept. 18, '00	Oct. 16, '00	Diffuse tuberculosis of peritoneum. Pancreas tuberculous.	Laparotomy. Removed fifteen pints of ascitic fluid. No drainage.	Died four weeks after operation, the disease progressing constantly.
8188	23	E. M. F.	30	F. M.	Sept. 21, '00	Oct. 31, '00	Diffuse tuberculous peritonitis, ascitic form. Ovaries and tubes in a mass of tuberculous tissue in pelvis.	Laparotomy. Removed large quantity fluid. Closed abdominal wound.	Recovered.
	24	A. W.	15	F. S.	Dec. 6, '00	Jan. 11, '01	Diffuse tuberculosis of peritoneum, with adhesions. Appendix free, but double normal size in a mass of tubercles.	Laparotomy, evacuated small amount of fluid also tuberculous appendix. No drainage. Intestines and omentum adherent, also ovaries, tubes and uterus. Adhesions not disturbed.	Recovered. Had severe attack of pleurisy with effusion four months later from which she recovered. May 20, 1902. The patient is in excellent health, living in California.
8529	25	H. W.	22	F.	Dec. 27, '00	Jan. 31, '00	Tuberculous Peritonitis and tuberculous appendicitis. No ascitis. Peritoneum studded with tubercles, but not completely covered, not much thickened.	Laparotomy. Excision of Appendix.	Recovered. May 16, 1902. Patient well one and one-half years after operation.
8559	26	C. J. B.	34	F. M.	Jan. 6, '01	Feb. 17, '01	Tuberculosis of peritoneum and appendix and Fallopian tubes. No ascitis. Peritoneum studded with tubercles in all parts, but not much thickened except over Fallopian tubes.	Laparotomy. Excision of Appendix, both ovaries and tubes.	May 12, 1902, sixteen months since operation, patient is well and has gained greatly in strength and somewhat in weight.
8963	27	A. S.	16	M.	Apr. 1, '01	Apr. 17, '01	Tuberculous Peritonitis, fibro adhesive variety with intestinal obstruction. Appendix imbedded in thick mass of tuberculous tissue. Entire peritoneum greatly thickened.	Laparotomy. Nothing removed. Wound closed.	Recovered. May 16, 1902. Patient is fat and well, about one year after operation.
9390	28	E. T.	56	M.	July 10, '01	Aug. 5, '01	Tuberculous Peritonitis. Abdomen distended with ascitic fluid.	Laparotomy. Drainage for one week.	Died five weeks after operation, disease progressing constantly, the pulmonary tuberculosis increasing enormously after the operation.
9789	29	F. J.	43	S.	Oct. 4, '01	Nov. 17, '01	Tuberculous Peritonitis. Intestines and omentum adherent. Ascitis twenty pints of fluid removed.	Laparotomy. Drainage for two weeks.	Not improved.
10003	30	Mrs. F.	40	F. M.	Nov. 25, '01	Jan. 15, '02	Tuberculous Peritonitis. Peritoneum two mm. thick Intestines and omentum and parietal peritoneum diffusely adherent. Two pints of fluid isolated in pelvis.	Exploratory laparotomy. Found it impossible to reach fluid without danger of causing intestinal fistula, hence abdominal wound was closed and pelvis drained through vagina.	Recovered. May 16, 1902, patient very well, able to do hard work five months after operation.
10224	31	Mrs. H.	33	F. M.	Jan. 22, '02	Feb. 20, '02	Tuberculous Peritonitis. Ovaries and Fallopian tubes surrounded by a mass of tuberculous tissue Cecum, small intestines and omentum also adherent in similar mass.	Laparotomy. Drainage for ten days. Five pints of fluid from space between tuberculous mass in pelvis and in upper portion of abdominal cavity.	Recovered. May 16, 1902. Patient is still weak, four months after operation.
10494	32	C. D.	19	F.	Mar. 18, '02	Apr. 15, '02	Diffuse Tuberculous Peritonitis. Appendix, cecum, ovaries and Fallopian tubes covered with thick masses of tuberculous tissue.	Laparotomy. Drainage.	Recovered. May 15, 1902. Patient well, two months after operation.

shows more perfectly the possibilities in these conditions than any of the cases in the present group.

In June, 1891, I operated upon a married woman, twenty-six years of age, whose ovaries, tubes and uterus were imbedded in a thick mass of tuberculous tissue so extensive that it seemed absolutely useless to attempt its removal. The cæcum, omentum and the small intestines were also matted together, a condition very similar to that found in Case 31. The entire parietal and intestinal peritoneum was thickly studded with tubercles. The remaining abdominal space was greatly distended with fluid and I simply inserted a drainage tube in the hope of giving the patient a slight amount of temporary relief and closed the remaining portion of the abdominal wound. She recovered slowly but was able to return to her home in six weeks. It is now eleven years since I performed this operation and the patient is a strong, healthy woman and has given birth to two healthy children. When I inquired, a short time ago, of her family physician for the date of her death after her return to her home from the hospital, I was amazed to learn of her subsequent history.

Case No. 8 of the present group is a similar example. This patient came under my care May 1, 1896, and was operated on the following day. She was then fifteen years of age, was reduced to a skeleton, weighing but sixty-two pounds. The abdomen was distended to the size of a five months' pregnancy, she was compelled to sit with her knees drawn up on her abdomen so that she rested her hands and her forearms upon them and on these she rested her chin. This was the only position in which she could be comfortable. I performed an abdominal section; finding four pints of free fluid. The intestines, omentum, ovaries and tubes were so thoroughly imbedded in masses of tuberculous tissue that the case seemed forlorn. A drainage tube was inserted. The patient began to gain slowly but steadily. She took anti-tuberculous remedies for several years and developed into a beautiful, healthy woman. In a letter I received a few days ago she states that her health is perfect, that she now weighs one hundred and twenty pounds—which is more than double her weight at the time of the operation and after the ascitic fluid had been removed. Her photograph, which she sent me, shows her to be vigorous, well-nourished, beautiful, and evidently completely recovered from her tuberculous disease.

Of the patient who died a short time after the operation, but not directly as a result of the operation, it seems important to observe that in Case 14 the condition was complicated with tertiary syphilis, the abdominal ascites, due to the tubercular peritonitis, increased constantly and the patient's condition became more serious under the anti-syphilitic treatment which had been instituted previous to the operation. It seemed as though the patient could be more readily relieved of the syphilis after being relieved of the ascites, but the result was quite the reverse. It is possible that the operation hastened her death, although she was rapidly approaching a fatal conclusion when the operation was performed.

Case 21 improved rapidly after the operation and was able to return to her home after one month, but succumbed to a new invasion three months later. It is not likely that the diffuse, miliary tuberculosis of which she died had any relation to her operation.

Case 22 was complicated with the comparatively rare condition of tuberculosis of the pancreas. The patient was more comfortable after the operation, but it is not likely that the procedure either lengthened or shortened her life.

In Case 27 a latent pulmonary tuberculosis became very active directly after the operation. It is probable that he would have lived a little longer without the operation. It has been observed that patients with a tubercular family history, suffering from even a slight pulmonary tuberculosis complicating the tubercular peritonitis, do not recover readily from the latter condition after abdominal section.

In twenty-one out of thirty-two of the patients in this series I have obtained definite information concerning their history after leaving the hospital. Of these cases fifteen are well from one to eleven years after the operation, five had died, two are too recent to be considered except from the standpoint of immediate recovery from the operation. Ten cases I have not been able to trace; they belong to the laboring classes who have no permanent homes.

All of these patients had been under internal treatment for a considerable period of time before the abdominal section was performed, without being benefited; several of those who have apparently made a permanent recovery were in what seemed to be a perfectly hopeless condition when they entered the hospital.

A study of the literature, together with a review of our clinical experience with the cases contained in the accompanying table seems to warrant the following conclusions which I have accepted:

1st. Patients suffering from tubercular peritonits should first be subjected to careful medical treatment.

2nd. This treatment should consist in the use of intestinal antiseptics and anti-tubercular remedies and rest in bed. Sterilized food and improved hygienic conditions generally should be employed.

3rd. So long as the patient's condition improves reasonably this treatment should be continued.

4th. In case the patient's condition does not improve abdominal section is indicated.

5th. If the disease is confined to a part which can be safely removed without injuring any portion of the tuberculous peritoneum this should be done, provided the surface can be covered with healthy peritoneum.

6th. If the removal of any infected portion necessitates the severing of the tuberculous peritoneum or leaving a portion of the peritoneal surface denuded, the diseased tissue must not be disturbed.

7th. In case there is fluid in the peritoneal cavity it is doubtful whether it is best to remove any tuberculous tissue, even though it be circumscribed.

8th. Enormous quantities of the tuberculous material can be absorbed from the peritoneal cavity after simple laparotomy.

9th. It is best to avoid all manipulation of the intra-abdominal organs during the operation, in case there is a diffuse tuberculous infection, and to confine the operation to simply opening the peritoneal cavity, permitting the fluid to drain out, admitting air to the peritoneal cavity, and closing the abdominal wound.

10th. Peritoneal adhesions should never be disturbed in patients suffering from tubercular peritonitis with ascites for fear of causing intestinal fistulæ.

11th. During the time of recovery from the surgical operation, and for a considerable period of time after this, the patient should be treated medically.

12th. The hygienic conditions of the patient must be permanently improved and he must not be permitted to expose himself to the conditions which primarily caused the tuberculous infection.

13th. Permanency of cure is much more likely in patients who are not predisposed to pulmonary tuberculosis.

14th. Chronic cases with fluid, particularly if encapsulated, and not benefited by medical and hygienic measures, are especially amenable to surgical treatment.

15th. Repeated operations are indicated in case of re-accumulation of fluid.

CYSTS OF THE PANCREAS.

Cysts of the pancreas are not of frequent occurrence. They can be differentiated from cysts of the ovary and from hydronephrosis by the fact that they are sessile, that they are located in the vicinity of the umbilicus, and that there is usually a history of rather severe traumatism.

The operation of removal consists in exposing the cyst, which is located retro-peritoneally. The fluid contained in the cyst is then aspirated, after tamponing away the remaining portion of the peritoneal contents, then the cyst is withdrawn through the abdominal incision, is opened, and the remaining contents evacuated by sponging; then it is attached to the transversalis fascia and peritoneum in the abdominal incision, the remaining portion of the abdominal incision being closed in the usual manner. A drainage tube and gauze tampon are inserted in the cavity of the cyst, which is permitted to close from the bottom. The operation is exceedingly simple and the results, in my experience, have been very favorable. The after-treatment is the same as following an ordinary abdominal section.

INTESTINAL FISTULA.

Intestinal fistulæ at the present time occur most frequently after operations performed for the relief of acute appendicitis complicated with the formation of extensive abscesses. These fistulæ are more common in cases in which the appendix itself has not been removed, or in cases in which the appendix has been removed at an inappropriate time or with extreme manipulations. The condition also occurs after other operations in which the intestinal wall has been injured either by disease or by the operation, or by the drainage tube which was supplied during operation. It is more common after operations which have been performed for the relief of inflammatory conditions, such as pyosalpinx. It also occurs after operations for strangulated hernia and after operations for the resection of any portion of the intestinal tract. After operations for the relief of tubercular peritonitis, in which the adhesions between loops of intestines have been separated, intestinal fistulæ frequently occur; they also occur after direct injury to the intestinal tract.

Treatment.—A considerable proportion of intestinal fistulæ will heal if absolute rest is secured as nearly as possible. This condition can be accomplished most readily by first emptying the alimentary canal thoroughly by means of large, repeated doses of castor oil, which will remove not only the food, but also all mucus contained in the alimentary canal. The fistulæ should be thoroughly cleaned by irrigation. This should be followed by feeding the patient exclusively by means of nutrient enemata. In this manner the intestinal canal can be kept relatively empty for a number of days, and in the meantime the openings in the intestine are likely to decrease in size unless there is a marked eversion of the mucous membrane. If this condition is present nothing but a radical operation will bring relief.

Operation.—It is usually wise to postpone the operation until the method above described has been thoroughly tried, because one will frequently succeed by the simpler method even after the fistula has existed for a considerable time, and this is especially true in fistulæ in portions of the colon where the bowel is covered with peritoneum.

Incision.—The incision through the abdominal wall should be made at some distance from the fistula to avoid the adhesions which one is sure to encounter at the point where the abdominal wall is penetrated by the fistula. The amount of traumatism necessary for performing the operation required is very much reduced if this precaution is taken, because the conditions can be determined much more perfectly if the abdominal cavity is opened at a point quite away from these adhesions. The incision in these cases should be sufficiently long to permit of performing the entire operation in full sight.

After the abdominal cavity has been opened all of the intra-abdominal organs should be tamponed away from the portion of the intestines involved, then these should be loosened from the abdominal wall and carefully brought out of the abdominal cavity so that all abrasions upon their surfaces may be carefully repaired. Attention is then given to the fistula itself. In cases following appendicitis operation the fistula most frequently enters the appendix at the point at which that organ was perforated during the acute attack. All that needs to be done in this case is to remove the entire appendix after the methods described in the chapter upon this subject. In these cases the method of separating the appendix first from its cæcal end and then dissecting it out distally is especially useful. It may be dissected out together with the fistula. The abraded surfaces upon the intestines which have been adherent must be carefully covered with peritoneum. It is usually well to pass a drain through the opening in the abdominal wall through which the fistula extended down to the seat of injury in the intestine, and then to completely close the new opening which has been made in the abdominal wall. If the fistula is in the cæcum it is usually not difficult to close it by means of sutures if the following points are borne in mind:

1st. The tissues to be sutured must not be cicatricial in character.

2nd. The sutures must be applied with great accuracy so as to have a perfect coaptation of surfaces.

3d. The sutures must not grasp too large an amount of tissue.

4th. The entire line of sutures when completed must be covered with healthy peritoneum or with a piece of omentum.

A drain should be placed down to the point of suture as described above.

In fistulæ of the small intestines it is usually advisable to make a resection of a considerable portion of the bowel, in fact, a sufficient amount should be removed to make the anastomosis between the ends in entirely healthy tissue. This can then be accomplished by means of the Murphy button, as described before; or by means of the continuous or interrupted intestinal suture, also described; or the ends of the intestine may be closed and a lateral anastomosis may be made after the method already outlined, which is the safest method as a rule. In any case the important point to be borne in mind is the fact that the operation must be done entirely in healthy tissue. The loss of a number of feet of small intestine is of practically no importance to the patient, but if too little is taken away for the sake of saving a small portion of intestine a subsequent perforation is liable to occur.

Fistulæ following operations for the relief of tubercular peritonitis can usually be healed only if the tuberculosis affects but a relatively small portion of the intestine which can be removed *in toto.* In this case the same conditions obtain which have just been described. In case the tuberculosis is not relatively circumscribed these fistulæ can virtually never be cured.

Occasionally an intestinal fistula is complicated with such extensive adhesions that it seems unsafe to loosen them, and then it may become necessary to make a lateral anastomosis between the intestine going toward the fistula and that coming from it in order to short-circuit the intestine at this point. It is best to pass a silk purse-string suture about the portion of bowel to be eliminated just beyond the anastomosis, in order to prevent intestinal contents from entering this portion. The suture should be applied subperitoneally and tied just tightly enough to accomplish this end without causing pressure necrosis.

CARCINOMA IN THE UPPER PORTION OF THE RECTUM.

If a carcinoma is located in the upper portion of the rectum it is often impossible to approach it from below, but it can be removed with ease through an abdominal incision. This operation is indicated only if the tumor is confined entirely to the intestine, because if the surrounding tissues have been invaded the removal of the tumor would in no way retard the progress of the disease.

Under favorable conditions, then, the following operation is indicated:

An incision is made through the linea alba extending from the pubis to a point an inch below the umbilicus. The intestines are tamponed away by means of moist gauze tampons. The sigmoid flexure is then found and grasped between two pairs of long-jawed pressure forceps placed side by side at a sufficient distance above the tumor to make sure that every portion of the growth is several inches below the lower pair of forceps. The intestine is then severed between these two pairs of forceps and a second incision is made in the left inguinal region, corresponding to McBurney's incision for the removal of the vermiform appendix only upon the opposite side, care being taken to separate the fibers of the external and internal oblique abdominal muscles. A pair of long-jawed pressure forceps is then passed through this opening and attached to the upper segment, which is withdrawn through this wound and carefully sutured to its edges, after a large rubber tube surrounding a glass cylinder has been inserted in this segment and fastened in place by means of a purse-string suture. This will permit the escape of gas and fæces without any danger of soiling the abdominal wound. The pair of forceps upon the lower segment is lifted toward the abdominal incision and the posterior attachment of the intestine below these forceps is successively grasped by means of pressure forceps, and as the attachment is grasped the intestine is cut loose. In this manner the entire intestine can be loosened without the slightest danger of hæmorrhage. If the diseased portion is not extensive two other pairs of pressure forceps are placed parallel to each other at a sufficient distance below the tumor to insure its complete removal. The intestine is cut off between these two forceps and the tumor, together with the forceps above and below it, removed. A purse-string stitch is applied around the lower segment and the edges caught by means of the pressure forceps are inverted. Then the entire abraded surface is covered with peritoneum and the abdominal wound is closed. Occasionally the sigmoid flexure is so long and its attachments so loose that it is possible to withdraw the upper segment through the lower segment by passing a double row of sutures around the entire intestine, grasping the upper edge of the lower segment and the outer surface of the upper segment which has been drawn into the lower. Before invaginating the upper into the lower segment the mucous membrane of the latter should be dissected out in order to obtain a raw surface to which the outer surface of the upper segment may become united. In this case tension stitches should be attached to the lower end of the upper segment, passed out through the anus and attached to the external skin. This will remove the tension from the row of sutures uniting the upper end of the lower segment and the outer surface of the upper segment. It is but rarely possible to perform this operation with safety, while the operation first described can be safely performed in quite a number of patients.

TUMORS OF THE ABDOMINAL WALL.

Lipoma.—Fatty tumors are occasionally found in the abdominal walls and can be removed without danger by simply making an incision down to the tumor, enucleating it, and closing the wound in the skin.

Fibro-Sarcoma.—Fibro-sarcomata frequently occur in the abdominal walls, taking their origin from any one of the various fasciæ; hence their name desmoids. These tumors usually follow severe straining during labor and most commonly occupy the lower end of the abdominal muscles.

These growths should be removed freely, a considerable amount of the surrounding tissue being sacrificed. This usually involves one or more of the important muscles of the abdominal wall which must be replaced by means of a plastic operation consisting in the splitting of other portions of the abdominal wall and overlapping. Fortunately these tumors are relatively not very malignant, and a number of cases have been permanently cured by the removal of these growths. It is usually well for patients to wear some form of an abdominal supporter after recovering from this operation.

Abscesses in the Abdominal Wall.—Abscesses in the abdominal wall sometimes follow traumatism, but more frequently result from an infection within the peritoneal cavity which has perforated a portion of the abdominal wall, or from infections of the ribs which have burrowed downward, or from empyemas of the chest which have burrowed downward, or from tubercular abscesses of the spine which have followed some portion of the transversalis fascia. The intra-peritoneal origin of these abscesses is most commonly the vermiform appendix, the Fallopian tube, the gall bladder, the stomach, the kidney, or the urinary bladder. Foreign bodies, such as needles or nails or sharp bones, may penetrate any portions of the alimentary canal and through adhesions of these to the abdominal wall penetrate the abdominal wall and give rise to abscesses.

Treatment.—If the abscess in the abdominal wall is not tuberculous in character it is best to lay it wide open, to curette away all the granular tissues carefully, and by looking for small areas in which granular tissue persists, one can usually follow the abscess to the point from which the infection originated. If this can be done and the cause removed with safety, it is well. If the origin of the infection cannot be found it is best to tampon the abscess cavity widely open and at the future dressings to look for the source of infection, which can be determined from the fact that at some point there will be a new accumulation of pus. Often during the original operation the source of infection can be determined by making pressure upon the surrounding portions of the abdominal wall and watching for some point from which pus shows upon such pressure.

Thoroughness in exploration is the foundation of success in operation for the relief of this condition. If it does not seem safe to follow the infection to its point of origin at the original operation it is often best to tampon the abscess cavity and later to approach the condition from the abdominal cavity through a new incision, the location of infection having been determined by the primary operation.

Surgery of the Chest.

EMPYEMA.

The most common condition of the chest for which surgical treatment is indicated is an accumulation of pus in the cavity thereof, the result of an infection due to the specific micro-organisms present in a preceding pneumonia, or the infection of the pleura by means of the bacillus of tuberculosis, or any one of the pus-producing micro-organisms. The condition is usually preceded by an inflammation of the pleura accompanied with serous effusion into the pleural cavity, which later becomes infected. This gives rise to the formation of the pus characterizing the condition of empyema.

DIAGNOSIS.—There is usually a history of pneumonia accompanied by severe pleuritic pains, or a history of apex tuberculosis. During the accumulation of pleuritic fluid there is shortness of breath and a short, irritable, hacking cough. If the condition is due to a tuberculous infection an evening temperature is likely to be noted; if due to an infection by the pneumococcus the temperature is liable to be persistent.

PHYSICAL EXAMINATION.—There is a bulging of the side of the chest involved; upon percussion there is dullness which varies with the position of the patient, except in cases in which the two layers of the pleura are adherent above the empyema. This condition is usually not present except in recent cases, hence it is not difficult to differentiate between the late stages of empyema and hydrothorax by physical examination. If the empyema is extensive there is usually a displacement of the heart. A good-sized trocar inserted between the ribs over the middle of the area of dullness may discover pus, but the absence of pus should not be considered as proof against the existence of an empyema, because it frequently happens that the pus is so much thickened that it cannot be withdrawn even through a large trocar. The trocar is useful to differentiate between the hydrothorax and an empyema because in the former condition the fluid is sufficiently thin to be forced out through the instrument. In tubercular empyema there is frequently much coagulated serum which cannot be forced even through a large trocar.

Indications for Operation.—In the presence of pus in the pleural cavity an operation is always indicated. If the patient's condition does not warrant the use of a general anæsthetic the operation can be performed with the use of a one per cent. solution of cocaine injected into the skin and into the sheaths of intercostal nerves a slight distance above the point at which the operation is to be performed. The point to be chosen for the operation is the middle of the area of dullness, usually about the sixth or seventh rib.

An incision from two to six inches in length is made parallel with the rib in the posterior axillary line. A longitudinal incision is made through the periosteum and this is removed by means of a periosteal elevator. A pair of bone-cutting forceps is then carefully applied to the rib at the posterior end of the wound; the rib is cut off, grasped by a pair of bone-holding forceps and lifted out of its periosteum to the extent to which its removal is desired. It is then cut off at this point with the bone-cutting forceps. The periosteum of the rib and the pleura now lie between the abscess and the operator. If the empyema has existed for a short time only it is not necessary to remove more than one segment of rib, but if it has existed for a considerable period it is often wise to remove a portion of two or more ribs at once in order to insure a sufficient amount of space for permanent drainage, as well as to provide for a certain amount of contraction of the chest wall.

A longitudinal incision is now made through the middle of the periosteum in order to avoid the intercostal vessels and nerves. This will permit the pus to escape from the pleural cavity. It is well to make this incision sufficiently large for perfect drainage. By inserting the finger through this opening one can determine accurately the extent of the pus cavity. A long pair of dressing forceps is now passed through this opening, across the cavity explored, and its end is forced out between two ribs on the anterior surface of the chest wall at a point suitable to the conditions present. An opening is cut down upon the forceps and two perforated rubber drainage tubes at least half an inch in diameter are drawn through this opening into the chest and out of the original incision behind. They are protected by means of safety pins at each end, and after the pus has been permitted to escape a large dressing composed of aseptic gauze and absorbent cotton is applied over both openings. Neither irrigation nor sponging is made use of. This dressing is changed as frequently as soiled, but irrigation is not practised at any time.

In patients with large accumulations of pus in the pleural cavity, especially if there is a communication between the abscess and a bronchial tube, it is often not safe to operate with the patient in the recumbent position. In such case it is best to aspirate most of the pus through a trocar at least two m.m. in diameter or to operate with the patient in the sitting posture.

In these cases, furthermore, the operation should always be performed with the greatest possible rapidity.

AFTER-TREATMENT.—In the after-treatment it is important in the first place to secure perfect drainage, which is insured in the operation which has been described from the fact that the drainage tubes extend entirely across the pus cavity and consequently when the diaphragm encroaches upon this cavity from below and the lung from above the through drainage persists. Were there but one opening in the chest wall a pocket might readily form at some point, but with the precaution of having two openings with drainage tubes extending from one to the other this cannot occur.

It is important to make the dressing large enough to completely close the opening against the entrance of air from without and to insure this by carefully applying bandages around the dressings to hold them in the desired position.

After the drainage has been greatly reduced it is wise to begin giving the patient systematic breathing exercises. He should be directed to inhale as fully as possible through the nose, keeping the mouth closed, and then to blow out forcibly through a tube with an aperture of about two millimeters diameter. These exercises should be frequently repeated during the day. It is well to continue in this respect for many months after the patient has recovered, because it will aid in overcoming the deformity which is sure to be present to some extent after the operation.

Even in cases of empyema not complicated with tuberculosis there is always a greater tendency to the development of this disease than in normal lungs; consequently these patients should be advised to live under favorable hygienic surroundings and they should be given general tonics whenever their condition of health requires. If there is any suspicion of the presence of tuberculosis anti-tubercular remedies should be given for a long period after recovery from the operation. If the empyema has resulted from a traumatism, such as a penetrating wound, especially a gun-shot wound made with ordinary firearms, the infection is frequently due to the fact that some portion of clothing has been carried into the pleural cavity and consequently it is well in these cases to make the opening in the posterior axillary line sufficiently large to enable a surgeon to examine the cavity for such substances.

DRAINAGE TUBES.—It is well to leave the drainage tubes in place until one is certain that the entire cavity has been closed down to these, because if they are left in place a little too long no harm can come from it, while if they are removed too soon a new pocket of pus may form, necessitating a secondary operation. If it seems desirable to reduce the size of the drainage tube it is well to draw smaller tubes through the entire distance so that the through drainage is maintained as long as drainage is made use of. If the granulations in the space occupied by the drainage seem flabby or unhealthy it is good practice to drop a small quantity of strong compound tincture of iodine into the cavity in order to produce a stimulating influence.

ACTINOMYCOSIS.

In the United States empyema caused by an infection with the ray fungus is not so very uncommon and should constantly be borne in mind as one of the possibilities, especially as the treatment must be entirely different in case actinomycosis is present. This condition can be recognized by the presence of little yellowish flakes in discharge from the empyema which contain the characteristic ray fungus, easily demonstrated by microscopical examination.

SPECIAL TREATMENT.—In cases suffering from actinomycosis it is important to bear in mind the fact that this disease is curable by the administration of very large doses of iodide of potash. Small doses are of little benefit. It seems necessary to saturate the blood thoroughly with this drug in order to destroy the parasite. The method which I have found most useful consists in the administration of sixty to ninety grains of iodide of potash in a glass of warm milk an hour after meals three times a day, followed by a pint of hot water. In this way the drug can be given in these large doses without causing any marked disturbance. It is used for three days in succession; then the patient is permitted to rest for the same period of time, when the administration is again repeated. After about six weeks of treatment these cases usually recover perfectly unless an undrained abscess be present. In such case some of the parasites seem to remain where the drug does not reach them and from that point a reinfection may take place; consequently it is wise to repeat the treatment a number of times after permitting the patient to rest for a month or two, when he has arrived at what is considered a complete cure.

CHRONIC EMPYEMA.

The drainage of an empyema of the chest does not always result in the complete cure of the empyema. This may be occasioned:

1st. By the contraction of the lung to such an extent as to leave a considerable space which is not filled by re-expansion.

2nd. By the unyielding condition of the chest wall.

3d. By the fact that there are sometimes a number of abscesses separated from each other by adhesions between the pulmonary and the costal pleuræ. It happens occasionally that only one of a number of these abscesses is opened, and then the drainage of that focus can, of course, not relieve the other abscesses. Frequently there are small sinuses communicating between the different pus formations so that there is a constant flow from an undrained abscess into the drained one; or this communication may from time to time become obstructed and then the drained abscess will approach complete healing only to have a new discharge of pus into it from its undrained neighbor. In such instances it is usually possible to locate the other abscesses by means of percussion.

Again the healing may be prevented because of the inelasticity of the thickened pleura which prevents it from applying itself to the surface of the lung. It frequently happens that the costal pleura is several centimeters in thickness. There may also be a necrosis of one or more ribs secondary to the pleuritic infection, which may again account for the fact that healing does not take place. In still other cases there is a constant reinfection from a tubercular abscess in the lung which perhaps did not directly communicate with the empyema at the time of the operation. All of these conditions, with the exception of the last one, can be relieved by a proper operation, which must have in view the application of the chest wall, or what is left of it, to the surface of the lung.

The operation to be chosen must depend upon the extent and location of the empyema. If this is confined to the lower portion of the chest cavity an excision of a number of ribs, beginning with the seventh, eighth or ninth and going upward until the upper edge of the empyema is reached, will usually suffice. The thickened pleura should be removed at the same time. The intercostal arteries should be ligated in this operation even though no hæmorrhage takes place at the time of the operation, or they should at least be crushed with clamp forceps because they frequently begin to bleed after the patient has recovered from shock, unless they have been properly disposed of.

If the empyema extends up to a point above the level of the lower angle of the scapula then it is usually wise to make a large flap of the chest wall with its base upward, cutting through the skin, the muscle, the ribs and the pleura, and cutting away a sufficient portion of the rib ends to permit this flap to sink into the cavity. Here again the intercostal arteries should be cared for. It is usually wise to apply a large tampon composed of aseptic gauze to the entire cavity and to lay the large flap which has thus been formed upon the surface of this tampon and then to apply a large dressing over it. This tampon is left in place for a sufficient length of time to stimulate the growth of vigorous granulation tissue over the under surface of this flap as well as over the surface at the bottom of the cavity. After the tampon has been removed the flap is placed in this cavity when permitted to heal in place. In this operation again it is often wise to excise a thickened pleura. If the condition is due to the presence of necrotic ribs these should be removed. If it is due to a reinfection from a tubercular lung either of the methods which have just been described may be used, but they are usually not followed by a complete recovery. Occasionally it seems best to treat a chronic empyema by laying the cavity widely open by one or the other of the methods just described, to apply a large tampon to the cavity thus exposed and to reduce this tampon slowly until the entire cavity has healed from the bottom. In chronic empyema I should say that the most important point consists in making the operation thorough enough.

ABSCESS OF THE LUNG.

Following pneumonia or an infection in some other part of the body, such as puerperal infection, an abscess in the lung not connected with the pleural cavity may occur. This may communicate with a bronchus and may evacuate itself thereby from time to time or it may remain circumscribed within the lung tissue. It is relatively easy to recognize this condition if the abscess cavity communicates with a bronchus because its filling and emptying can be observed. If it is near the costal surface of the lung it can be recognized by percussion, giving much the same sound that is obtained upon percussion over the surface of the liver. If the abscess is not at the edge of the lung resonance will be observed above it, below it and to each side of it, giving the impression of a circumscribed space filled with fluid. Its presence usually gives rise to an abnormal temperature, which frequently reaches 104, 105 and 106° Fahrenheit.

Treatment.—The rational treatment must, of course, consist in the evacuation of the abscess externally. There is, however, one great danger in this operation resulting from the fact that in order to approach the abscess the pleural cavity must be opened, and if an adhesion does not exist between the pulmonary pleura and the costal pleura the lung is likely to collapse. This condition frequently results in the death of the patient, and in order to guard against this the surgeon should be prepared to inflate the lung through a tube inserted into the larynx constructed so that its ends will fit tightly between the vocal cords. Its top should be connected with bellows by means of which the collapsed lung can be inflated. The apparatus known as the Fell-O'Dwyer is very simple and efficient, and this, or a similar apparatus, should always be procured whenever the operation here mentioned is undertaken. A U-shaped incision should be made over the area covering the abscess and the flap turned back, exposing two or three ribs. Portions four inches in length of at least two ribs should be resected with great care, in order not to penetrate the costal pleura until sufficient space has been secured to repair the mischief which might occur from the sudden collapse of the lung. After this area has been laid bare the portion of the lung opposite may be grasped by means of fine volsellum forceps through the costal pleura, or fine stitches of cat-gut may be passed through the costal pleura and the adjoining lung at several points, or an apparatus for inflating the lung may be applied and the lung filled with air by compressing the bellows, and then the costal pleura may be opened and the lung sutured to this opening, or it may be sutured to folds of iodoform gauze which are drawn over the edge in the opening in the costal pleura so that the lung cannot be retracted.

A method which has been very satisfactory consists in suturing with cat-gut pieces of wet gauze to the parietal pleura and lung around the edge of the opening before the pleura is opened; the moist gauze prevents the entrance of air and consequently pneumothorax cannot occur. The abscess is then best entered by means of the actual cautery, because the opening thus made will enlarge when the escar caused by the burn becomes separated.

Upon introducing the finger into this cavity bands will be found to pass through it which the surgeon attempts to break down in order to reduce the entire space into one cavity. These bands frequently contain large blood vessels and it is consequently best to apply hæmostatic forceps to them and to cut between these. The cavity may be drained by inserting a few strands of gauze; then the wound is dressed as in the operation for the relief of empyema.

In case the abscess of the lung approaches the pleura, adhesions between the pulmonary and the costal pleuræ have usually formed so that there is no danger from the formation of pneumothorax, but it is never safe to operate in these cases without being prepared to find no adhesions present. Here again a large dressing is indicated, and it is wise not to permit the external wound to heal too soon after the operation.

GUNSHOT AND STAB WOUNDS OF THE CHEST.

In the treatment of gunshot or stab wounds of the chest it is, first, important to determine whether there is dangerous bleeding from the intercostal vessels or from the internal mammary artery. The former can easily be exposed, clamped and ligated. The latter, being located near the sternum between the costal cartilages and the pleura, is in a position in which it is difficult to ligate without fear of causing pneumothorax by opening the pleura. The fact that this vessel is given off from the subclavian artery makes the hæmorrhage very formidable, and the fact that it is located behind the costal cartilages makes a hæmorrhage into the pleural cavity more likely than an external hæmorrhage. In case of bleeding from the internal mammary artery it is necessary to bear in mind the fact that the costal cartilage can be easily cut with an ordinary scalpel and that the external wound is of no importance, consequently a large external wound should be made over the costal cartilage of the next rib above the point of injury, this cartilage should be carefully cut away for a distance of at least an inch over the point at which it crosses the artery, and then a fine stitch should be passed around the artery and tied. The danger from trying to perform this operation through a small external wound is very much greater than it is if ample space be secured by making a large external wound.

The hæmorrhage from these two sources having been disposed of the next important point is to secure, as nearly as possible, complete rest of the chest walls. This can best be accomplished by applying a plaster-of-Paris jacket extending from the lower border of the ribs up over both shoulders. The patient will immediately begin to breathe by using the diaphragm alone and the irritable hacking cough will in most cases subside, and therefore the patient will stop pumping blood from the lung tissue into his pleural cavity. If empyema follows through an infection caused by the injury it should be treated according to the method which has already been detailed.

This point should be borne in mind above all things—that under no condition should a wound of the thorax be examined with a probe, because probing is one of the chief sources of infection. If plaster-of-Paris is not available, or if the patient does not seem sufficiently strong to bear its application, a protecting cast can be constructed in a few minutes by winding long strips of rubber adhesive plaster, from two to three inches in width, about the entire chest, beginning at the border of the ribs and working upwards until the whole chest and shoulders are covered. Several layers of this plaster may be applied to advantage. It is surprising how quickly a patient who has not been able to rest for a moment on account of the irritation due to the motion of his chest walls, will become quiet and fall asleep after one or the other of these jackets has been applied. Cases which have so far advanced that the danger of new hæmorrhage is over, but in which the blood in the pleural cavity is not absorbed, should be aspirated through a trocar or drained by open incision or treated like an empyema.

PNEUMOTHORAX.

If the wound in the chest wall has been sufficient to admit a quantity of air the lung will become compressed and a pneumothorax will be formed. All that is required for the relief of this condition is the closure of the external wound, unless there has been a complete collapse of the lung, in which case the lung should first be distended by means of inflation before the opening in the chest wall is closed, or the opening may be closed and the air contained in the chest cavity may be aspirated by a pump through a trocar. If, however, air is forced into the pleural cavity from the lung itself by the injury of the lung tissue then it may become necessary to make a rib resection, to grasp the injured point of the lung with forceps to draw it to the external wound and there to attach it, after the manner described in the operation for abscess of the lung. The wound in the lung, however, is usually so small that it closes spontaneously, or it is so large that the patient succumbs before the surgeon has an opportunity to secure relief by an operation.

HYDROTHORAX.

Hydrothorax is so easily recognized by physical examination that it is scarcely worth while to discuss it. It is so common in its occurrence that it rarely reaches the hands of the surgeon. The accumulation of fluid in the pleural cavity may absorb spontaneously or it may be withdrawn by aspiration. Only a part of the fluid should be withdrawn at one time. Many authorities prefer to withdraw but a few ounces and to depend upon absorption for the removal of the remaining portion, which usually occurs after a few ounces have been aspirated. Other surgeons prefer to remove a considerable proportion of the fluid. There is no doubt but that it is wise never to remove the entire amount present.

TUMORS OF THE CHEST.

Of tumors of the chest which are interesting in a surgical way only those due to the presence of hydatids, actinomyces and syphilis, and dermoid cysts, need to be mentioned. Sarcomata, carcinomata and endotheliomata occur but are not interesting in a surgical way except from a diagnostic standpoint.. Hydatid cysts most frequently occur through perforation of the diaphragm on account of infection from hydatids of the liver. This condition is treated in the same manner as empyema. Actinomycosis has already been discussed. Gummata are treated by means of internal medication if the condition is recognized. Dermoid cysts are enucleated, the same precautions being taken to prevent collapse of the lung which were described in connection with the treatment of abscess of the lung.

Lympho-sarcomata are of especial interest because their usual location about the diaphragm makes the differentiation between this condition and empyema difficult at times.

MEDIASTINAL ABSCESS.

This condition is recognized by the symptoms of weight and pain in the retro-sternal region. The pain is increased especially upon drinking, coughing, and upon pressure. There is frequently a swelling over the surface of the sternum. The condition is treated, when diagnosed, after the same manner as abscesses in general. An opening is cut in the sternum and the pus permitted to evacuate. The cavity is then drained by means of strands of gauze carried to the bottom of the abscess.

TUBERCULOSIS OF THE STERNUM.

The sternum may be removed in part or entirely for tuberculosis, precisely as one would remove a tuberculous rib. If possible the costal attachment should not be disturbed. The operation is not especially dangerous because there is in these cases a sufficient support on account of the presence of connective-tissue which has formed behind the sternum as a result of the long continued inflammation which preceded the destruction of this bone.

INFECTIONS OF THE MAMMARY GLAND.

These occur most commonly through abrasions of the nipple during nursing. The mouth of the child may contain the infectious micro-organisms or they may be upon the surface of the nipple when the child is applied, or fissures may occur and the staphylococci which are ordinarily found in the skin may cause the infection. The arrangement of the lymph channels and milk ducts, and the connective tissue structure of the breast, radiate in every direction from the nipple as a center. The infection may follow one or more of these structures and may become localized at a smaller or greater distance from the nipple. It may progress to the formation of abscesses varying in size and location.

Examination.—Upon examination one or more points of induration are commonly found. The tissues over these points are œdematous and there is pain upon pressure. If the infection is advanced there is also redness or fluctuation present. The acuteness of the attack will differentiate this condition from tumors.

Aside from the history of lactation there may also be a history of traumatism, or there may be evidences of an infection in some other portion of the body.

Treatment.—Early in the occurrence of an infection of the breast it is frequently possible to cause it to subside by securing absolute rest. The blood supply of this portion of the body is so plentiful that an extensive amount of infectious material may be entirely absorbed if the progress of the infection is not favored by motion. The patient should be placed in bed and the breast supported by strapping, preferably with rubber adhesive straps which have been carefully applied, or with an accurately applied flannel or elastic rubber bandage. If the infection is quite slight then a large, moist, antiseptic dressing covered with rubber protective tissue will probably favor absorption, the patient of course being kept at rest. Further infection should be prevented by thoroughly washing the nipples before and after each nursing and by applying some antiseptic substance, such as ointment containing boric acid or some substance like tincture of benzoin or tincture of myrrh, which has a protective effect on account of its resinous character. Solutions of rubber have been prepared which may be applied to the nipple after it has been carefully dried, and which will serve as an excellent protective covering. Above all things the nipples should be kept clean at all times and should be carefully washed just before and just after nursing. The child's mouth should also be washed in order to prevent infection from this source. The milk should be pumped out of a breast at regular intervals, care being taken not to cause any traumatism of the infected tissues by the manipulations which are necessitated.

Operation.—If the infection progresses to the formation of circumscribed abscesses these should be incised freely and drained by the insertion of gauze or gutta percha tissue drains and a sufficiently large dressing should be applied to absorb all of the discharge. Personally, I prefer a moist antiseptic dressing consisting of one part of alcohol with two parts of saturated solution of boric acid for this purpose.

It is important that the incisions should be made in a manner so as to cause them to radiate from the nipple in order to prevent cutting off any of the ducts which branch from this point. Rest in bed and support by means of dressings and bandages should be insisted upon, because this will prevent any formation of further abscesses by progressive infection after the primary focus has once been opened.

Chronic Mastitis is the result of a deep-seated infection with pus microbes of moderate virulence. This condition may give rise to the diagnosis of tumor of the breast.

TUMORS OF THE BREAST.

Benign Tumors.—The most common benign tumor in the breast is the fibro-adenoma. Pure fibromata and pure adenomata are exceedingly rare. Aside from these are found retention cysts, lipomata, enchondromata, and, very rarely, hydatid cysts. All of these tumors are likely to occur in young patients. They are movable and are not accompanied with retraction of the nipple. They give rise to no pain and rarely grow to any considerable size.

Treatment.—There is a tendency in all tumors of the breast, with the exception of lipomata, to become malignant later in life; consequently it seems wise to remove every benign tumor in this location as early as possible after it has been discovered. The operation is safe, does not inconvenience the patient, and may relieve her of a very serious danger. The incision should be made

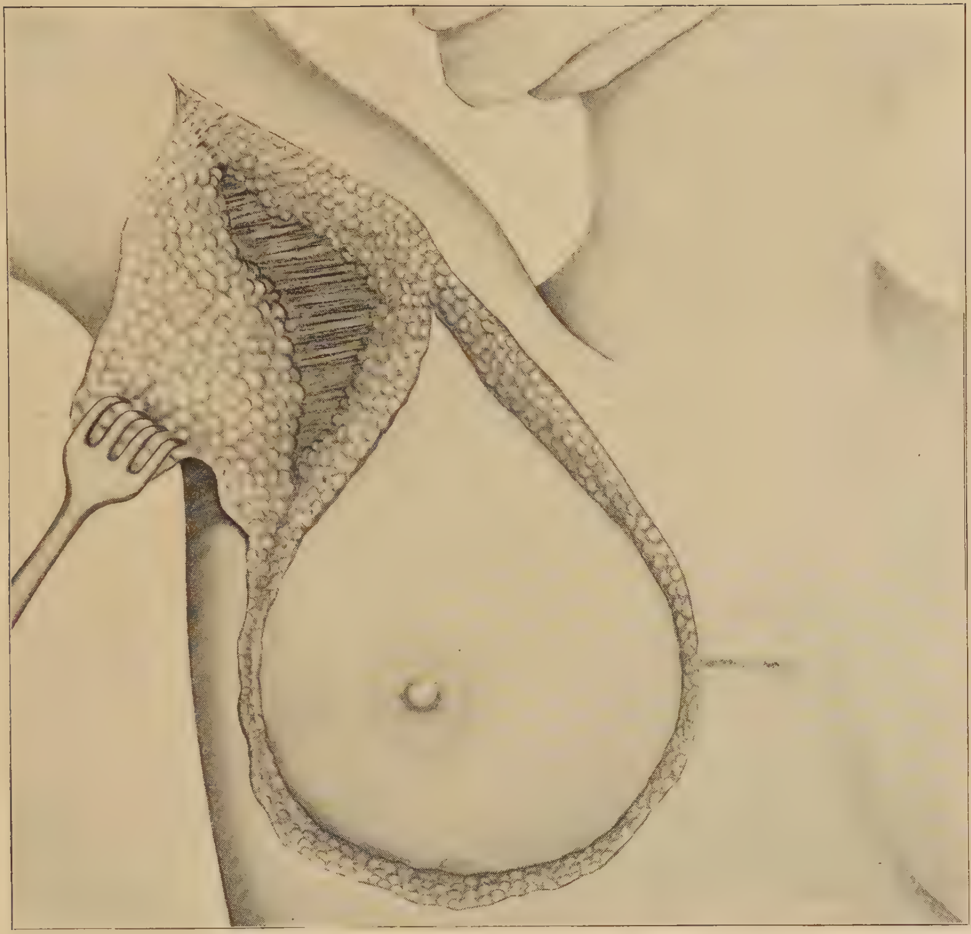


PLATE LV.

AMPUTATION OF BREAST.

The incision extends in front of the axillary space and includes a considerable amount of skin overlying the mammary gland.

as much as possible in the direction indicated in the previous operation.

MALIGNANT TUMORS.—Carcinomata are the most common of all malignant tumors of the breast. Epitheliomata are less frequent; sarcomata still less frequent in their occurrence. Paget's nipple, which is a dermatitis with a tendency to the development of epithelioma, is not very common in this country.

HISTORY.—Heredity is supposed to be an important element in the history of malignant tumors of the breast. The growth itself may have existed in the form of a benign tumor for a considerable period of time or it may appear in the form in which it persists. Its location is more commonly directly underneath the nipple, but it may appear in any portion of the breast. At first it is movable, but later it becomes adherent to the skin or to the fascia of the pectoralis major muscle. One of the signs which has been recognized as characteristic is the retraction of the nipple due to the contraction of the underlying trabeculæ of the connective tissue. This condition, however, is present only if the tumor is near the nipple. If the growth is slow the tumor is hard. If it is rapid it may be either soft or hard upon pressure. Sooner or later the disease progresses along the lymph channels, forming secondary nodules in the lymph glands, first in the axillary region, second, in the infra-clavicular region and later in the supra-clavicular region. Later, lymph channels extending toward the skin are invaded and the latter is presently destroyed, giving rise to an open ulcer.

At this point I wish to state emphatically that observations have convinced me that an enormous amount of harm is done to patients suffering from incipient carcinoma of the breast by the careless manipulation of this organ by the physician or surgeon making the examination. I believe that many times I have seen the growth of carcinoma of the breast largely increased in this manner. I believe also that I have observed cases in which secondary infection of the lymphatics, and even of the liver, was caused by frequent manipulation. During the past few years I have encountered a number of patients suffering from this condition who were treated by severe massage at the hands of osteopathic healers, in whom there was an enormous increase in the growth of the tumor in a relatively short time, and in several cases a secondary infection of the liver. In the same manner an infection with carcinoma may extend into the chest following the lymphatics which accompany the internal mammary artery, or the opposite breast may be invaded because of the lymphatic connection of the two organs, or it may extend along the intercostal lymphatics into the spine, giving rise to paraplegia dolorosa. If there is any doubt as regards the diagnosis of carcinoma of the breast I believe that in every case it is much better for the patient to have the organ removed at once, and with the same care that would be exercised if its malignancy were positively known, rather than to temporize until the condition is so plain that the surgical treatment is usually useless and the patient is in a hopeless state.

Carcinoma containing an abundance of connective tissue is more likely to occur in patients advanced in years and the malignany of this form is not so great as the malignancy in carcinoma with but a slight amount of connective tissue. The latter form of carcinoma is more likely to occur in young patients, usually under fourteen years of age. Sarcoma is also more likely to occur at this age, while epithelioma, starting in the skin and penetrating the deeper tissues, is more apt to develop in patients over forty years of age; but it is not safe to depend upon the age in making a differential diagnosis between benign and malignant tumors of the breast.

To differentiate between chronic mastitis and tumors, when the breast is pressed against the chest wall with the hand in mastitis the enlargement is of uniform consistency, in tumors there is a nodular arrangement of the thickening.

Operation.—There are a few important principles which should be borne in mind in the removal of a carcinoma of the breast:

1st. The direction in which carcinomatous infection progresses from the primary seat of disease, and consequently the direction in which recurrence is likely to take place, should be noted. Bearing this in mind, it is important to remove a large portion of skin overlying the tumor, as shown in Plate LV, even though the tumor itself be quite small.

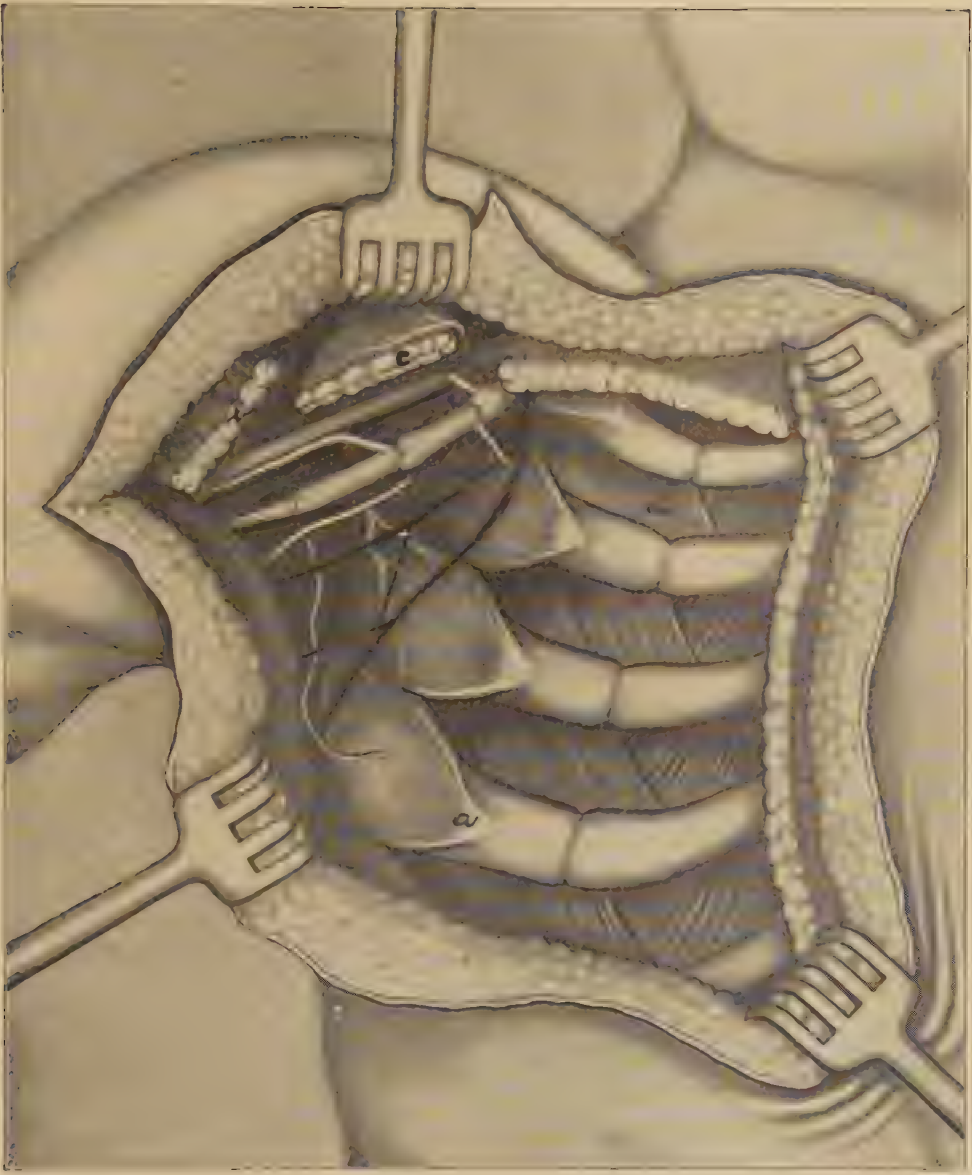


PLATE LVI.

AMPUTATION OF BREAST

The breast, pectorales major and minor and the axillary fat are completely removed; (b) shows the external attachment of the pectoralis major; (c) the pectoralis minor muscle.

2nd. The subcutaneous fat should be removed for a great distance.

3d. All the tissues to be removed should be included in a continuous mass to prevent the infection of any portion during the progress of the operation from an exposed part of the malignant growth.

4th. All the soft tissues down to the ribs, to a point up under the clavicle, as far as possible into the axilla, including the overlying skin, the superficial and deep fascia, the fat, the entire breast enclosed in its capsule, the pectoralis major and minor muscles, and all the axillary and subclavian fat, together with the lymphatic glands contained in it, should be removed in one mass, as shown in Plate LVI.

5th. The patient must be protected against too great a loss of blood.

6th. The important subclavian and axillary vessels and the pleura must not be injured.

Incision.—Many incisions have been planned and for each certain advantages are claimed. It is probably of little importance which incision is chosen. A very good exposure can be obtained by making a curved wound beginning at a point four inches below the axilla along the anterior surface of the deltoid muscle, extending across the chest at a sufficient distance from the tumor to insure safety against infection, usually a distance of six to ten centimeters from the nipple will suffice, then carrying this incision around the breast at a uniform distance from the nipple and extending upwards to the original incision. After grasping the bleeding vessels with pressure forceps the skin around the edge of this incision should be dissected up, the underlying fat being left attached to the chest wall. This dissection should be carried a sufficient distance back to include all the diseased tissue, at least five centimeters in each direction in ordinary cases. The incision is then carried down to the ribs along the border of this area and the entire mass, as described before, is dissected up to a point approaching the axillary vein, care being always taken to grasp the bleeding vessels with pressure forceps. Then the attachment of the pectoralis major to the humerus is severed and, later, the upper attachment of the pectoralis minor is also divided. Between these two attachments it is wise to grasp the vessels with two pairs of forceps and to cut between these and to ligate the stump toward the axillary side. The distal ends of the subclavian and axillary veins are now dissected free, all the small branches issuing from the veins being caught in two pairs of hæmostatic forceps. Cut between these and ligate the end toward the axillary vein close for fear of tearing the latter with the forceps. By proceeding slowly with this portion of the operation it is possible in a comparatively short time to lay bare the entire vein without doing any harm to this structure. The dissection is then carried downward through the axillary space, and the entire mass is cut away from its posterior attachment, the bleeding points having been caught carefully during each step of the operation so that the entire amount of blood lost will be slight.

It is important that the tumor be not manipulated roughly because it seems likely that carcinomatous cells could be loosened from the substance of the growth if careless handling or pressure be allowed.

If there still remain small portions of fat attached to the axillary structures they can be removed with great rapidity and perfect safety by grasping these structures in a piece of moist gauze held in the hand and drawing this gauze over these structures, permitting them to slip through the grasp of the hand holding the gauze. In this manner these small portions of fat containing minute lymphatic glands can be removed more perfectly and with much greater ease and rapidity than by actual dissection. All the bleeding vessels which have been caught, in which the bleeding has not been stopped permanently by the pressure of the hæmostatic forceps, should be ligated. Personally I make use of fine cat-gut for this purpose.

The area exposed is so enormous that a certain amount of serous discharge must be expected, and consequently I believe it is wise to insert one or two moderate-sized drainage tubes through an opening in the posterior flap, as shown in Plate LVII. The wound is then united by means of interrupted tension sutures, for which silk or silk-worn gut may be employed, and coaptation sutures for the purpose of adjusting the edges of the wound. If these edges cannot be adjusted without applying a great amount of

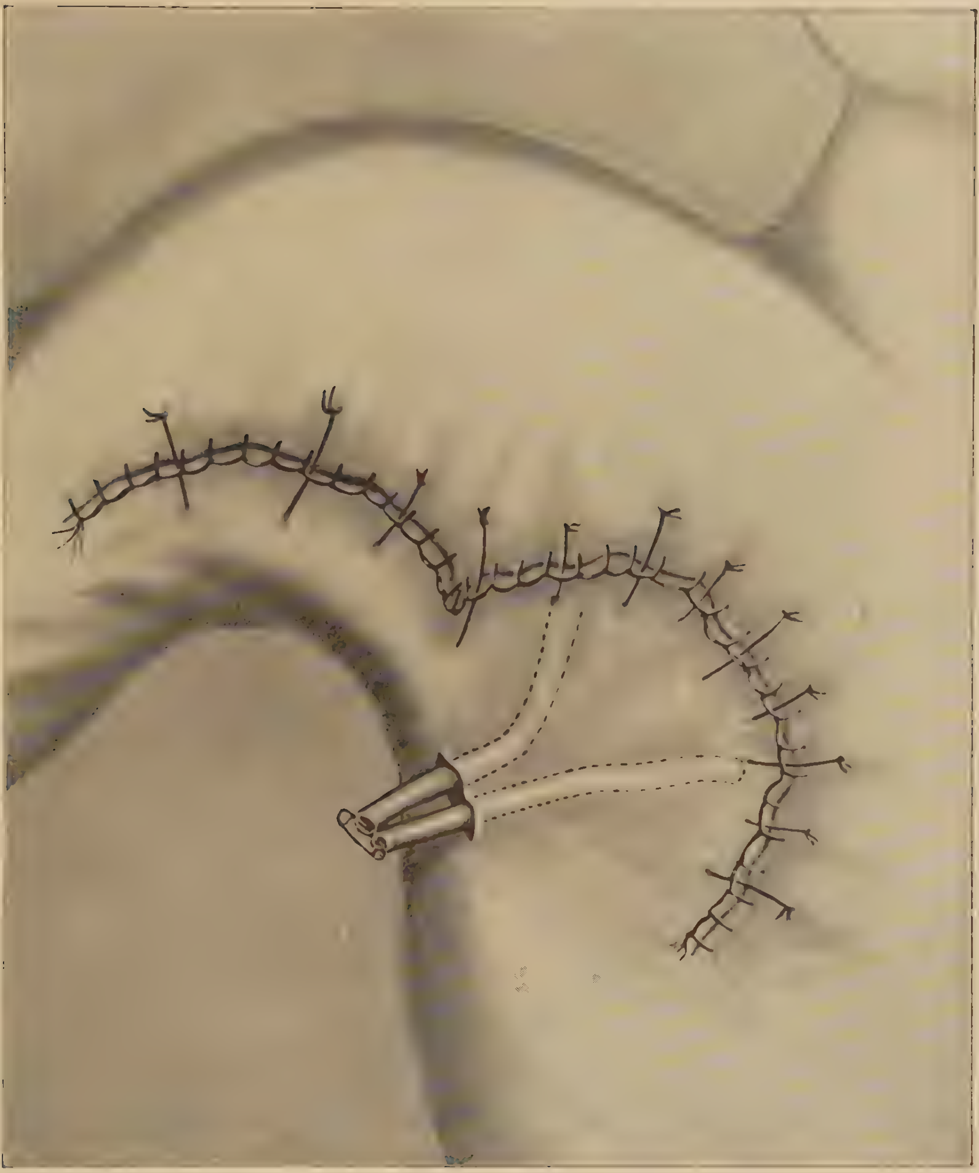


PLATE LVII.

Amputation of Breast

Closure of wound with interrupted silkworm gut and continuous horsehair sutures. Rubber drainage tubes in place.

tension it is much better to leave a space between the edges of the wound and to cover this by means of Thiersch's skin grafts. A large dressing is applied to the breast in order to approximate the skin flaps to the chest wall by means of gentle pressure. The arm, to the elbow, is included in the bandage, but should not be tied down sufficiently firm to make the patient uncomfortable.

DISSEMINATED LENTICULATE CARCINOMA OF THE SKIN OF THE BREAST. (CANCER EN CUIRASSE.)

This form of carcinoma occurs not infrequently as a direct cancerous infection of the lymphatics of the skin after an operation for the removal of primary carcinoma of the breast. The infection may also occur directly from the primary carcinoma. The French name, indicating the appearance of a coat of mail, is so characteristic that one can scarcely fail in making the diagnosis in these cases. Near the region of this complication the skin is thickly studded with nodules, usually red in color, and radiating from this area to a considerable distance will be found smaller lenticular nodules. A few times I have observed this form of secondary carcinoma originating in the stitch mark, indicating that the carcinomatous tissue was directly inoculated in the skin from the deeper portions. It is likely that the subcutaneous fat contained the carcinoma cells in these instances and that these cells were carried by the needle into the overlying lymphatics of the skin proper.

Treatment.—The surgical treatment must be entirely prophylactic. By removing a large portion of the overlying skin, together with the carcinoma of the breast, it is likely that this complication will be prevented.

During the past year a number of these apparently hopeless cases have recovered after the use of the Roentgen rays. Whether this recovery is to be permanent or temporary remains to be seen. In my own experience no patient has ever presented herself for treatment of this condition to whom I could promise any surgical relief. Whether the excision of a large portion of skin and underlying fat would give relief in cases coming under treatment very early I am unable to state.

EPITHELIOMA OF THE BREAST.

Primary epithelioma of the nipple is not very uncommon. Its progress is likely to occur more rapidly into the deep structures than into the surrounding skin. Even at a very early stage there has usually been a secondary infection of the tissues of the breast itself. In a few instances in which the disease seemed to be very limited I have found that there was an infection not only of the tissues of the breast, but also of the axillary lymphatic glands.

Treatment.—The conditions just described will of course indicate that the same plan of treatment must be followed which has been indicated in connection with carcinoma of the breast proper. If anything less is done the progress of the disease will only be increased and the patient is likely to succumb sooner than she would if nothing were done in a surgical way; in fact, with a thorough removal of the skin, the breast, the pectoralis major and minor muscles and the axillary and subclavian lymphatics and fat, these patients are likely to recover permanently.

SARCOMA OF THE BREAST.

The diagnosis of sarcoma of the breast can usually not be made positively until the tumor has been removed. This is of little importance because the same operation must be performed which would be performed in the presence of a carcinoma.

TUBERCULOSIS.

Patients suffering from tuberculosis of the breast usually give a history of tuberculosis in some other portion of the body, most commonly pulmonary tuberculosis. In many cases there is the history of an injury; in others the history of localized tuberculosis of the lymph glands in other portions of the body. The history, together with the general appearance of the patient and the fact that the axillary glands are usually enlarged, while the examination of the breast itself gives the impression one obtains in manipulating a chronic mastitis or a multiple fibro-adenoma of the breast, usually suffices to make a fairly positive diagnosis of tuberculosis. There are, however, cases in which it is not possible to differentiate this condition from carcinoma. If the disease has existed for a more or less extended period of time some portion of the growth will have usually undergone caseous degeneration, giving rise to the sensation of fluctuation, which will also serve as a diagnostic sign. The nipple is usually retracted.

TREATMENT.—The treatment should consist in the removal of the entire breast, together with the lymphatic glands and fat of the axilla. It is not necessary in this condition to disturb the pectoralis major or minor or the fascia covering the former. Unless there is present a mixed infection of some broken down portion of the tumor it is usually safe to close the entire wound without drainage.

MILK FISTULA.

Following an incision into the breast for the drainage of an abscess, or following the spontaneous opening of an abscess of the breast, and occasionally following traumatism, a fistula remains connected with one of the milk ducts which secretes milk either constantly or intermittently.

TREATMENT.—In recent cases these fistulæ can sometimes be cured by cauterizing the external opening, or by curetting the fistula, or by making a longitudinal incision through the fistula, but in chronic cases a careful excision of the false passage is necessary in order to secure permanent relief.

Surgery of the Neck.

This subject more than almost any other under consideration depends upon diagnosis and the practical appreciation of the anatomy of the region. Almost all of the pathological conditions occur in structures surrounded by vessels and nerves of the greatest importance, which adds greatly to the fascination of the surgery of this part.

GOITRE.

In this country patients suffering from goitre rarely afford a characteristic history such as they give in portions of Switzerland, France or Wales, where certain regions seem to furnish a very large proportion of patients, while others are relatively free from them. The enlargement of the thyroid gland more commonly appears about the age of puberty than at any other time. It also occurs during gestation in quite a number of patients. It happens much more frequently in this country in females than in males. It may affect any one or two, or all of the lobes of the thyroid gland. When the middle lobe is involved there is frequently an enlargement extending down behind the upper end of the sternum, causing quite severe pressure upon the anterior surface of the trachea. The patient may seek relief because of the deformity caused by the presence of the tumor, because of its weight on the neck or because of the obstruction in the trachea produced by pressure from a lobe of this gland. The enlargement may be due to an increase in the parenchyma of the gland or one of the lobules may be distended with gelatinous or serous fluid giving rise to the formation of a cyst, or there may be a fibrous degeneration of a portion of the gland or the development of a fibrous tumor, or, especially in patients advanced in age, there may develop a malignant growth, either carcinoma, sarcoma, endothelioma or angioma. The enlargement may also be due to a simple infection with its skin œdema.

Diagnosis.—The diagnosis of a tumor of the thyroid is simple because of the form and location of this gland; also from the fact that if the patient swallows the gland rises with the larynx, being firmly attached to the trachea. An enlargement due to an inflammatory condition can be easily recognized because of the symptoms accompanying inflammatory conditions in any part of the body. Malignant growths are characterized by an induration of the tissues, which is not present in a benign growth of the thyroid gland. The age, and, usually, a rapid development of cachexia, are important conditions to be considered in making this differential diagnosis.

Treatment.—In young girls the enlargement commonly subsides if general hygienic measures are employed. This can be somewhat facilitated by administering, three times a day, tablets containing five grains each of the desiccated thyroid gland of sheep, the doses being somewhat varied according to the condition of the patient. General tonics are indicated in these cases. In older patients the absorption of these growths is sometimes further facilitated by the hypodermic injection of from sixty to one hundred and twenty drops of a five per cent. solution of carbolic acid in water directly into the enlarged lobe. This should be done once each week at first and less frequently later on. The same hygienic and tonic measures should be employed as in younger patients.

EXOPHTHALMIC GOITRE.

Goitre is frequently accompanied with a prominence of the eyes and a condition of the heart known as tachycardia, an affection which is in itself much more grave than the usual condition of goitre. The management of these patients should at first be medicinal and hygienic, but if this treatment fails to give relief after thorough trial for a reasonable period of time surgical means should be instituted. In these patients I have not seen any benefit from the use of carbolic acid injected directly into the enlarged glands.

During the past year we have treated cases suffering from exophthalmic goitre, as well as those suffering from parenchymatous enlargements of the gland, by the application of X-rays, the tube being placed at a distance of fifteen centimeters from the neck. In these cases there has been a very marked improvement, but I am not prepared to say whether this was due to the treatment or whether it was simply a coincidence.

In the event that none of the methods described seem to benefit a patient, then the removal of the gland is indicated, but this should not be done during the time of an acute exacerbation of the nervous symptoms. The pulse should be reduced in frequency by the administration of remedies before the operation is performed. If the pulse is above 130 beats per minute the operation is extremely dangerous.

OPERATION.—There are several distinct dangers in this operation, but all of them can easily be avoided.

1st. The danger of hæmorrhage.

2nd. The danger of opening a large vein and causing air embolism.

3d. Injury to the recurrent laryngeal nerve, resulting in paralysis of the larynx.

4th. Poisoning of the patient by forcing an abnormal amount of the secretion of the gland into the circulation by pressure.

5th. Sepsis extending into the mediastinum.

6th. The development of cachexia thyreopriva following the operation.

7th. There is considerable danger from the use of an anæsthetic.

These dangers should be kept fairly in mind because they are of exceedingly serious import and upon their full appreciation depends the success as well as the safety of this operation.

INCISION.—An incision should be chosen which will leave the least possible amount of deformity, relatively speaking. If the operation is to affect one of the lateral lobes the lateral incision should extend in the direction of the sterno-cleido-mastoid muscle and fall in the natural line, irregular upon the surface of the neck. If the middle lobe is involved the incision should pass across the neck below, and its position should be chosen so that it will be covered by a collar which can be comfortably worn by the patient. If both lobes are involved then both lateral incisions should be symmetrical. It is wise to avoid the center of the neck over the isthmus or over the larynx in making the incision because this is the most prominent portion and consequently a cut at this point will result in the greatest deformity. The skin and superficial fascia are first dissected away, then the incision passes through the platysma myoides muscle, and then the surface of the thyroid gland, as well as the inner edge of the sterno-cleido-mastoid muscle, is exposed. From this point on it is important to exercise great care as regards the control of hæmorrhage, inasmuch as the veins upon the surface of the gland are likely to be unusually large and very irregular, which obviously increases the likelihood of injury to these structures. The edge of the sterno-cleido-mastoid muscle should now be dissected out for a distance of an inch above the upper end and below the lower end of the enlarged gland. The muscle should be loosened very thoroughly so that it can be retracted outward without the necessity of using much force. Blunt retractors should be used for retraction because of the proximity of the deep jugular vein, which in these cases is frequently quite thin-walled. The outer surface of the thyroid gland is now thoroughly exposed. Any irregular veins which may enter the structure are grasped between two pairs of hæmostatic forceps and are cut between the same. If the veins are especially thin-walled it is well to ligate them before proceeding with the operation for fear of causing hæmorrhage by tearing. The gland is now loosened from its external attachments and lifted up firmly but gently, because rough manipulation at this point is liable to force secretion of the gland into the general circulation, which may be followed by a dangerous form of intoxication. The gland is now lifted entirely out of its position. This step has been aptly termed, dislocation of the gland. This facilitates the following steps because it exposes the superior and inferior thyroid vessels. The superior thyroid vessels are first grasped in two pairs of forceps, cut and ligated. The inferior thyroid vessels are then very carefully exposed because of the danger of injuring the recurrent laryngeal nerve at this point. This nerve passes upwards directly underneath the inferior thyroid artery, being recognized as the small whitish line upon the side of the trachea. If the inferior thyroid vessels are caught without careful exposure there is great danger of grasping the recurrent laryngeal nerve with the forceps, causing paralysis of the vocal cords. These vessels having been exposed, caught in forceps, ligated and cut, the thyroid gland is easily freed from its attachment to the trachea by blunt dissection, but in this step have in mind the great danger of injuring the recurrent laryngeal nerve because of its attachment to the trachea at this point.

If only one lateral lobe is diseased its attachment to the isthmus is now severed behind, the cleavage being carefully sought and small vessels at this point can be caught easily and ligated. If the middle lobe is also involved then this attachment is not severed, but the middle lobe is drawn upwards, away from the trachea, by its attachment to the lateral lobe which has just been entirely freed with the exception of its attachment to the isthmus. It frequently happens that the middle lobe exends behind the posterior surface of the sternum and there causes pressure upon the trachea. Patients in whom this condition is present frequently suffer severely from dyspnœa during the first portion of the operation, but this subsides at once as soon as the injured portion of the gland is withdrawn from its location behind the sternum.

Before drawing out this portion of the gland it is well to inspect the anterior surface of the gland because upon this surface are frequently seen several very large, thin-walled veins which are easily enlarged and which should be caught between two pairs of forceps and cut and ligated before this portion of the organ is manipulated. Its attachment to the anterior surface of the trachea is easily loosened and then the point of cleavage between the middle and second lateral lobe should be sought and severed. Here again there may be bleeding from a small vessel, which is easily compressed and ligated. If the third lobe is also greatly diseased it is well to remove a portion of it, but at least one-half of one lobe should be left in place to prevent the occurrence of cachexia thyreopriva.

The whole surface is now carefully inspected, any bleeding areas are caught in pressure forceps and ligated. The extent of the space and the proximity of the middle lobe to the mediastinum makes it advisable to insert some form of drainage, either a strand of gauze, a small elastic rubber drain, some strands of catgut or silk-worm gut or a portion of gutta percha tissue folded several times upon itself. This drain may be removed two days after the operation with perfect safety.

The incision in the platysma muscle is now closed with a few stitches and then the skin is carefully sutured up to the point at which the drain has been inserted. If the suturing is carefully done and the stitches are not drawn very tightly scarcely any scar will be left.

ENUCLEATION.—If the enlargement in the thyroid is circumscribed, taking the form of a fibroid tumor or a cyst, usually colloid, or a circumscribed adenoma, it is somewhat unnecessary to remove an entire lobe of the gland. In this case an incision is made over the enlargement in such a manner as to produce as little deformity as possible. Then the capsule of the gland is split, care being taken to grasp portions of the capsule between two pairs of forceps before cutting it in order to prevent hæmorrhage. When the nodule in question is exposed a point of cleavage between it and the remaining portion of the gland is sought and the mass is readily enucleated either with the finger, a Kocher's director or a blunt dissector. In case of troublesome hæmorrhage tension is made upwards upon the forceps which have been applied to the capsule and a few stitches are passed through the walls of the cavity from which the growth has been removed and tied with just sufficient tension to overcome the bleeding. The capsule is then sutured and the skin is sutured over it. If the cyst is of large size the whole lobe of the gland should be thoroughly exposed.

If the precautions which have been mentioned in this article are borne in mind the operation is relatively very safe, unless it is done during a condition of severe dyspnœa, which may occur at any time in cases in which there is much pressure upon the trachea and an acute œdema of the growth. In such an event it is frequently unsafe to anæsthetize the patient and then it is best to cocainize the line of skin incision with a one per cent. solution of cocaine and to infiltrate the deeper layers with a one-tenth of one per cent. solution of cocaine in a normal salt solution. In this case the pressure is almost always due to an enlargement of the middle lobe, and it is consequently wise to make a horse-shoe-shaped incision through the skin with the convexity downward, to grasp the vessels rapidly between two pairs of forceps, to cut them, and as soon as the middle lobe is exposed to insert into it sharp-pointed retractors with at least four teeth, the ordinary catspaw variety being the most useful, and with these to lift the lobe upwards and thus to dislodge it from its location behind the sternum where it causes the pressure which gives rise to the condition of dyspnœa. After this lobe has once been dislodged the dyspnœa ceases and the remaining steps of the operation can be completed without difficulty and without danger to the patient. I have found it necessary to operate upon patients in this condition in the sitting posture because in the recumbent position they were entirely unable to breathe.

MALIGNANT GROWTHS OF THE THYROID.

Operations for the relief of malignant growths of the thyroid have been so unsatisfactory in their results that it seems doubtful whether they should be undertaken. It is to be hoped that our experience in the use of the X-rays will continue to be favorable in these cases, but at the present time nothing positive can be said in this regard. If a removal is made the same steps are carried out that have just been described.

TUBERCULOUS GLANDS OF THE NECK.

General Considerations.—In the treatment of tuberculous glands of the neck the first consideration must be the removal of tuberculous material from the body in order to prevent further infection. The glands which are first infected have progressed furthest in the changes which are due to the presence of tubercle bacilli. In the earlier stages the gland is hypertrophied and contains numerous tuberculous foci which may be separated by normal gland tissue, or a number of these foci may have developed so closely together that they will form one nodule. Presently more and more of these foci will develop in close proximity and then the nutrition of this portion of the gland will become impaired and caseous degeneration will take place. It is important to bear this in mind because in this way one can recognize the direction from which the infection has taken place, which will affect the plan of treatment. The source of infection is most commonly found in tubercular foci which have developed in the tonsils. This infection may occur from particles of food containing tubercle bacilli becoming lodged upon the surfaces and upon crypts of the tonsils, or from particles of sputa containing bacilli lodged in the same manner, or from mucus descending from the posterior nares containing bacilli which have been lodged in this mucus from dust in the air.

Patients suffering from tuberculous glands of the neck have usually lived in surroundings in which the dust was likely to contain tubercle bacilli because of the careless disposition of sputum of patients suffering from tuberculosis of the lungs, or they have been in the habit of drinking unsterilized milk.

In my own practice children living under unhygienic surroundings in houses containing tuberculous patients, and children coming from the farms where they live to a very large extent upon uncooked milk, are the two classes in which I have found this condition most commonly. In the vast majority of these patients I have been able to determine the presence of tuberculous foci in the tonsils in children or in the apex of the lungs in adults. These facts are of very great importance because if they are not recognized our treatment is not likely to benefit the patient greatly, as a reinfection is almost certain to occur as soon as the patient is exposed to the conditions which first gave rise to the disease.

HISTORY.—The patient before us, a young lady eighteen years of age, living at home and taking care of her three younger sisters, gives the following history:

Her mother died at the age of forty-two from tuberculosis of the lungs, when our patient was but twelve years of age. The father is in excellent health; her three younger sisters are also in perfect health. The patient suffered from whooping-cough, measles and scarlet fever while still young, having the last named disease at the age of six. After this time she suffered frequently from a mild form of tonsillitis, the tonsils remaining greatly enlarged and swelling to such an extent as to almost close the pharynx and making it difficult to breathe through the nose whenever they were at all congested. Shortly after her mother died she first noticed a small swelling beneath her left ear. This varied in size, but was always larger when she suffered from colds. Several months ago her general condition became impaired and she became quite anæmic. At about the same time she noticed several swellings beneath the first one and a further swelling beneath the angle of the jaw on the left side. These swellings have increased in size slowly but constantly, the latest one being located directly above the clavicle.

Present Condition.—The patient is fairly well nourished; her appetite is fair; her tongue is clean; the bowels are fairly regular; the temperature is normal; pulse 100, full and strong; her heart, lungs and kidneys are normal. The patient is quite markedly anæmic. There is a series of swellings extending from a point beneath the mastoid process along the anterior border of the sterno-cleido-mastoid muscle down to the clavicle; also several nodules beneath the angle of the jaw on the left side; also a deep swelling apparently underneath the sterno-cleido-mastoid muscle. None of these swellings fluctuate. The examination of the blood shows the amount of hæmoglobin decreased, but otherwise the blood is normal.

Diagnosis.—This history is a difficult one in cases of tuberculosis of the cervical glands. Scarlet fever and measles are so common in this community that it would be difficult to prove a connection between these conditions and tubercular glands of the neck, but in a majority of these cases one will find that a certain amount of infection remains in the tonsils, which in turn undoubtedly makes the tuberculous infection of the lymphatic glands of the neck more likely.

In this case the oldest child was associated with her mother during the latter's sickness from pulmonary tuberculosis, the younger children being cared for by relatives. This would account for the infection of the oldest daughter and for the freedom from infection in the three younger daughters. The slowness in the progress of the disease can be accounted for by the fact that the child was naturally strong and healthy and that she has always lived under good hygienic surroundings, with the exception of the time during which she lived with her sick mother. The same conditions account for the good health of her younger sisters.

The history contains one feature which is quite common in these cases, viz.: that relating to the variation in the size of the glands during the early part of the infection; the increase in size corresponding to the time when the patient was suffering from cold—in other words, during the time of acute reinfection. Had this patient been subjected to proper treatment at this time it is quite possible that the existing swelling in the glands would have disappeared entirely, but one cannot make a positive statement regarding this, because the existing initial infection is much more severe in some cases than in others.

TREATMENT.—During the past four months this patient has been treated very properly by means of internal medication. She has been given tonics, her work in school has been interrupted, and she has been out of doors a great share of the time. Her household cares involved by the presence of her younger sisters have been reduced. She has also received some form of creosote, which is supposed to have a direct effect upon the tuberculous infection. Her general health has been greatly improved in the meantime, but there has been a slight increase in the size of the swellings, although this has been very slow.

There are two reasons why in this case this form of treatment has not resulted in a reduction in the size of these swellings, or possibly a cure. In the first place the primary source of infection is in the tuberculous foci contained in her greatly enlarged tonsils. In the second place the degree of infection in the lymphatic glands of her neck has already advanced to such a point that its absorption is not to be expected. It will consequently become necessary for us to relieve her by means of operative treatment.

OPERATION.—In this operation we must consider:

1st. The deep jugular vein, because its injury would be likely to result in the introduction of air into the circulation, causing air embolism and death.

2nd. The carotid arteries and the pneumogastric nerve.

3d. Some of the more important branches of the spinal accessory nerve must be preserved, because their injury results in marked deformity and consequent discomfort to the patient.

4th. The scar should be so placed as to cause in itself as little deformity as possible.

INCISION.—An incision is made along the anterior edge of the sterno-cleido-mastoid muscle from the mastoid process down to the clavicle. The superficial fascia is then carefully dissected back on each side of this incision. The first incision severs the external jugular vein, which should at once be caught and ligated on each side of the division, or it is still better to grasp the vein between two pairs of forceps and to cut it after it has been thus caught, and to ligate at once. The edges of the wound should now be carefully retracted and a dissection should be begun at the lower end of the incision. It should be carried on carefully until the sheath of the deep jugular vein is reached. This should be followed upwards until the entire vein has been laid bare from the clavicle to the angle of the jaw. The lymphatic glands are closely adherent to the sheath of the vein, but with the vein plainly in view there is no danger of injuring it if the dissection is carried on carefully.

About an inch below the angle of the jaw we find several enlarged glands in this case. This is at the point at which the facial vein enters the deep jugular vein. It is a favorite location for a tuberculous lymphatic gland. Great care must be taken in dissecting out this gland because one is in danger of injuring the facial or the deep jugular vein, or both. In this instance it is possible to secure a sufficient amount of space without making a transverse incision, but occasionally it is necessary to carry the incision some distance below the lower jaw and parallel with this in order to remove all the submaxillary glands. It is not unusual to find the submaxillary lymphatic gland infected with tuberculosis, which necessitates its removal. If this is necessary it is best to grasp the facial artery and vein between two pairs of hæmostatic forceps and to cut between these just below the point where they enter the submaxillary salivary gland, because in this way one can prevent some hæmorrhage and prevent the clouding of the field of operation. To the outer side and behind the deep jugular vein the lymphatic glands are also enlarged and we will carry our dissection upwards behind the edge of the sterno-cleido-mastoid muscle. About half the distance between the lower and the upper attachment of the sterno-cleido-mastoid muscle, or at a point at which the trapezius muscle approaches the former, several branches of the spinal accessory nerve will be encountered. It is important to preserve these because their destruction will result in a drooping of the shoulder and an atrophy of the muscles of the lower part of the neck. In making the dissection from below upwards the superficial cervical nerve will be encountered passing transversely across the sterno-cleido-mastoid muscle about its middle. A little above this point the spinal accessory nerve passes out of the sterno-cleido-mastoid muscle and passes backwards and downward into the trapezius muscle. The superficial cervical nerve being larger and more superficial serves as a guide to the more important spinal accessory nerve. The latter should be carefully dissected out to its insertion in order to avoid an accidental injury.

We have now disposed of all of the enlarged glands with the exception of those underneath the upper portion of the sterno-cleido-mastoid muscle. These can be approached by making a transverse incision through the sterno-cleido-mastoid muscle or by splitting the latter longitudinally, or, better still, by dissecting the muscle entirely free and drawing it out of the field of operation by means of retractors. The last of the three methods mentioned will be carried out in this case, because this does the slightest amount of injury to this important muscle, and the other methods are undoubtedly both harmful and unnecessary.

We have now carefully removed all infected glands. It is my practice to apply to all the raw surfaces the strong compound tincture of iodine with the expectation of destroying any bacilli which may still remain in these tissues, and also with the idea of stimulating the tissues to increased healing. Other surgeons use different antiseptics for the same purpose, and still others use none at all, and apparently all are equally successful.

It is wise to supply some means of escape for the serum, which will accumulate during the first twenty-four hours, from the large raw surfaces which have been made. In order that the flaps may not be separated by accumulating serum, had they once united, we will insert a small drain in the lower angle of the wound, and then we will unite the edges of the wound, using the utmost care to secure a most perfect coaptation, because in this way we will be able to avoid as much as possible the formation of a disfiguring scar.

I am in the habit of uniting the fascia with a separate row of catgut sutures in order to avoid a depression of the scar.

The most important part of the operation still remains, because if we should leave this patient in her present condition she would be virtually worse off than she was when we started the operation, because in removing the diseased lymphatic glands we have undoubtedly removed many normal lymphatic glands which might serve to protect the patient against further invasions through the same source of infection, for this source of infection still remains—in other words, we have not only relieved our patient of her diseased lymphatic glands, but also of many lymphatic glands which if left in place would serve to protect her. We must, therefore, remove the cause of infection in this case, which exists in the tubercular foci in her tonsils and in the adenoids in the post-nasal space. We will consequently place this patient in the inverted position and permit her head to hang backward over the end of the table. I will then insert a gag between her teeth in order to keep her mouth open, and then will remove both tonsils, and by means of a broad, flat, post-nasal curette I will curette away the adenoids, protecting the uvula and soft palate by inserting the left index finger. In order to complete the removal of these adenoids we will further insert a small, ordinary, moderately-blunt curette through the nostril, and, guiding the spoon with the left index finger in the pharynx, will curette away all of the remaining granulations. This step is taken first through one nostril and then through the other until the pharynx is perfectly free from adenoids. At the same time we will examine the patient's mouth and if she has any decayed teeth which will be the source of infection they will be removed.

After-Treatment.—In these cases it is especially important that the after-treatment be carefully supervised by the surgeon. One of the most important features of the after-treatment consists in instructing the patient to take breathing exercises systematically. It is our practice to have these patients inhale through the nose with closed lips, filling the chest completely, and then exhaling while they resist with the lips. The most convenient way of accomplishing the latter step is by placing between the lips a small tube about two millimeters in diameter. This exercise should be practised at least twenty times in the morning and again in the evening.

The hygienic surroundings of the patient should be favorable. The room should be high, dry and sunny. The food should be nourishing and simple and the patient should have an abundance of outdoor exercise. Tonics and anti-tubercular remedies should be given systematically until the patient has fully recovered, and a patient's habits should be so formed that it becomes natural for him to live hygienically.

It is far more important that these last directions be carried out than that the tuberculous glands be removed, because if these hygienic measures are carefully followed the patient will usually live much longer and be in much better health, even though the glands be not removed, than would obtain if the glands were removed after the most perfect method and no attention be paid to the dangers by reinfection. The plan which must consequently result in restoring these patients permanently to good health and lengthening their lives to the greatest possible amount consists in removing all of the infected glands as well as the primary foci of infection whenever this is possible; in improving the hygienic conditions and the food of the patient; and in administering tonics and anti-tubercular remedies; and this can only be accomplished by impressing the patient with the importance of all of these conditions.

The principles laid down above as regards the operation and after-treatment for the removal of tuberculous glands in this region will obtain without regard to the location in the body of the tuberculous glands. It is characteristic for these glands to be adherent to the veins wherever they may occur because the lymphatic glands which are most likely to be infected by tuberculosis are all located in close proximity to larger veins in the body.

PROGNOSIS.—If the tuberculous glands of the neck which do not disappear under internal and hygienic treatment, and after the removal of the focus from which the original infection has taken place, are removed, and the internal and hygienic after-treatment which has been outlined here has been followed, then the prognosis in these cases is good both as regards immediate and permanent results. If broken down tuberculous glands of the neck are not removed the degeneration may proceed to calcification of the caseous portion of the gland and the patient may still recover, or adhesions may take place between the gland and surrounding structures and the accumulation of tuberculous material may result in a sufficient amount of pressure necrosis of the overlying tissues to cause a perforation through the skin and spontaneous drainage. This may continue for a considerable time or may be relieved by means of an operation. In the former case the patient remains ill a long period and if a spontaneous cure results it will be accompanied with a considerable amount of deformity.

Again, the infection may progress from one set of glands to another until all of the cervical lymphatics have been involved. Then the space occupied by the lymphatics extending from the neck into the axilla behind the clavicle may become affected and there may be a tuberculous infection of the axillary lymphatic glands; or, again, the infection may extend along the median line into the cavity of the chest. Each of these conditions is, of course, much more serious than the original infection; consequently the danger should be interrupted before it has progressed to one or the other of these unfortunate results.

HODGKIN'S DISEASE.

The lymphatic glands of the neck frequently undergo a form of enlargement and degeneration which is probably also infectious in its character, but in which we are not able at the present time to determine the nature of the infection. The condition is rarely entirely confined to the neck, but the lymphatic glands in other portions of the body are likely to be enlarged also. These glands are harder and usually more closely grouped than in tuberculosis. The patient is anæmic or cachectic in appearance. Upon removal of a gland it is found to contain a uniform structure in which there are no circumscribed tubercles or foci of caseation. These glands contain an abundance of connective tissue and the spherical cells of the normal lymph gland have lost their characteristic appearance.

This condition may be distinguished from the enlargement of the same glands due to leukæmia by the fact that the blood does not show the marked increase in leucocytes that characterizes the latter disease. The removal of the enlarged lymph glands in Hodgkin's disease does not benefit the patient except when their presence interferes with respiration by pressure upon the trachea. In a few cases there has been a rapid disappearance of these glands under treatment with the X-ray, but it will be necessary to follow these cases further before anything positive can be said on this subject.

ENLARGEMENT OF CERVICAL LYMPHATIC GLANDS COMPLICATED WITH LEUKÆMIA.

The mode of differentiating between this condition and the other two forms of enlargement of the cervical lymphatics has just been described. The treatment in these cases should not be surgical in character.

LYMPHO-SARCOMA OF THE NECK.

This disease is differentiated from the other conditions which are similar in appearance, and that have just been described:

1st. By the absence of a history of tubercular infection.

2nd. By the fact that the surrounding tissues are invaded very soon after the beginning of the condition.

3d. By the rapidity of its development; and

4th. By the early appearance of cachexia.

TREATMENT.—The excision of a sarcoma of the neck is the only treatment which has heretofore seemed to promise anything for the patient. From the anatomical conditions present in this region an extensive removal is, of course, not possible, and consequently these cases, with very few exceptions, have been hopeless; and still there are undoubtedly a few cases which have recovered permanently. In this condition it is again worth considering the advisability of further experimentation with the X-ray.

CARCINOMA OF THE LYMPHATIC GLANDS OF THE NECK.

This is always secondary to the presence of carcinoma of some portion of the face, pharynx or tonsil, which will differentiate it from the conditions which have just been described. Thorough surgical removal is the only treatment that promises anything for these cases, with the possible exception of treatment by the X-ray, which here again requires further testing. The condition is almost hopeless.

BRANCHIAL CYSTS.

During the early development of the embryo there are four clefts on each side of the neck corresponding to the gills in fishes. These latter become obliterated, but occasionally the layers do not unite perfectly and there are left portions of the epiblastic tissue which have not been destroyed and which will later secrete a fatty substance which will accumulate in this defect and will presently form what is known as a branchial cyst.

DIAGNOSIS.—The cyst develops slowly, is located underneath the skin and superficial fascia, fluctuates upon palpation, and is not inflammatory in character.

TREATMENT.—The incision is made over the cyst in the direction of some of the longer lines of the neck, and upon approaching the cyst a point will be reached where there is a longer line of cleavage between the tissues. By separating the cyst from the surrounding tissues through this latter it can be easily removed. The wound is closed and it heals kindly. By finding the natural line of cleavage one can remove the growth without any danger of injuring the deep jugular vein in whose proximity it exists, and even if there has been an inflammatory condition which has resulted in adhesions to the deep jugular vein the growth can readily be removed by careful dissection without danger.

SEPTIC INFECTION OF DEEP TISSUES IN THE NECK.

Quite frequently in infants, and occasionally in adults, there is a septic infection of the deep tissues of the neck resulting from an infection of the tonsil or some portion of the pharynx. The condition is violent in its onset and there is a severely indurated, extensive swelling which usually begins in the upper portion of the neck and extends downward. The induration is often so severe that fluctuation cannot be determined. Pus, however, is always to be found in the deeper tissues and its removal by means of an incision, and the subsequent application of drainage and a moist antiseptic dressing, results in a rapid recovery. The incision should be made carefully, because there is sometimes a displacement of the anatomical structures, and unless care is taken these are likely to be injured during the operation.

TORTICOLLIS.

Space will permit us to discuss only the treatment of the non-spasmodic form of torticollis which depends upon a shortening of the sterno-cleido-mastoid muscle. The form of treatment which we have found most satisfactory in these cases consists in carefully dissecting out the sterno-cleido-mastoid muscle, or what is left of it, together with the cicatricial tissue which may compose a portion of the muscle. Having laid bare the entire muscle it is split in halves longitudinally to a point within an inch of its upper and to the same distance with regard to its lower extremity. Each half is now permitted to remain attached to one end, while at the other end of the incision through the muscle it is cut loose so that the upper attachment carries one-half of the muscle and the lower attachment the other half. The head is now turned so that the chin reaches the shoulder of the side on which the short muscle exists in order to determine the length desired, and the two ends are united by means of a number of fine catgut sutures. After the head is turned back so that the chin is opposite the sternum the sutured muscle will appear considerably relaxed. It will give the impression of being quite a little too long. It is now covered with the superficial fascia by means of a row of catgut sutures and the skin is sutured over all. This leaves the diseased side entirely without tension. The muscle usually fills up quite rapidly, and, in our experience, the deformity has not recurred and the function has been very satisfactory.

TRACHEOTOMY.

Since the introduction of diphtheria antitoxin tracheotomy is performed almost entirely for the relief of obstruction to respiration due to the introduction of foreign substances into the larynx, such as the inspiration of kernels of corn, or other objects, by children in their play, or the forcing down of the diphtheritic membrane in the attempt to introduce an intubation tube. It is also performed for the removal of foreign substances which have been inspired and for the relief of obstruction to the larynx due to malignant growths.

Incision.—The seat of the operation may be chosen either above or below the isthmus of the thyroid gland, or in case the patient is in danger of asphyxiation, necessitating a very rapid operation, the incision may be made directly through the isthmus of the thyroid gland, the latter having previously been grasped between two pair of hæmostatic forceps. When the operation has to be performed with extreme rapidity it is best to place the patient in the inverted position with the head dependent so that any blood which it may not be possible to control at once will gravitate away from the opening in the trachea and will not be inspired. If sharp tenaculæ are at hand it is wise to plunge two of these directly through the skin into the trachea on each side of the median line and then to make an incision directly into the trachea with one sweep of the knife and to hold the incision open by drawing upon the tenaculæ while artificial respiration is performed. In the meantime the bleeding vessels can be caught, and if a tracheotomy tube is at hand this can be inserted. This, however, is not at all an attractive operation and should never be performed except in case of absolute necessity. If the operation can be done leisurely the important points to be considered are:

The control of hæmorrhage in the successive steps before the blood vessels are cut. An incision should be made in the median line and each blood vessel caught with two pairs of hæmostatic forceps as it appears in the wound, and then the incision should be continued. In this manner the operation should proceed until the rings of the trachea are plainly in view; then all the vessels should be carefully ligated and any further bleeding points caught with forceps and tied, and then the two tenaculæ should be passed through one of the tracheal rings to either side to the median line and then the trachea should be incised longitudinally, one, two or three cartilaginous rings of the trachea being cut transversely. If the operation is performed for the removal of a foreign body from the trachea or larynx it is wise to have an experienced assistant prepared to catch the foreign body the moment the trachea is opened, because the foreign body is frequently forced out, together with a lot of tenacious mucus, the moment the trachea is incised. After this there is usually a deep inspiration which may again draw the substance into the trachea and possibly cause it to become lodged in one of the larger bronchi. It may be difficult to dislodge it from such a point.

After-Treatment.—In the after-treatment of these cases it is wise to guard against the irritation of the lungs on account of the effect which the air has in coming directly in contact with the mucous membrane of the trachea and bronchi without first passing through the nose and pharynx. This irritation can be avoided by placing over the opening a wire frame on which a layer of gauze has been stretched, which is kept moist with normal salt solution.

The tracheotomy tube should consist of an outer and an inner tube, the latter being changed frequently enough to prevent the accumulation of mucus. It is a good rule to leave a tracheotomy tube in place as short a time as possible, because some portion of the higher tube is liable to do injury to the trachea, and the longer it is left in place the greater is the likelihood of permanent injury being done to this structure.

INTUBATION.

Since the introduction of antitoxin, intubation has been found quite sufficient to relieve the obstruction of the larynx due to diphtheria. It is rarely necessary now to leave a tube in place for more than one or two or, at most, three days, because the diphtheritic membranes have usually disappeared entirely within this time if large doses of antitoxin have been given.

The difficulties which accompany intubation are:

1st. The danger of forcing portions of the diphtheritic membrane down into the trachea.

2nd. The danger of injuring the vocal cords.

3d. The danger of the patient coughing out the tube in the absence of the physician and the inability of the nurse to replace it.

4th. The difficulty some people have in taking food in the presence of an intubation tube.

5th. In rare cases the intubation tube will touch a point in the larynx, at the base of the epiglottis, which seems to produce an immediate paralysis of the respiratory centers, causing almost instant death unless artificial respiration be performed until the effect of this traumatism has passed away.

(1.) The first difficulty must be overcome by an immediate tracheotomy; consequently the surgeon should always be prepared to perform a tracheotomy before he begins to perform intubation. This, however, becomes necessary only very rarely, but when it does the conditions are so urgent that unless the surgeon is prepared to perform tracheotomy at once the patient will probably be hopelessly asphyxiated before the necessary preparations can be made.

(2.) The second danger can be avoided by great care in performing the operation.

(3.) Since the introduction of antitoxin I have never seen a case in which the child suffered seriously from coughing out the intubation tube. Whenever this has happened there has usually been at the same time a loosening of a portion of the membrane so that a replacement of the tube was not necessary.

(4.) Patients who find difficulty in taking nourishment can usually be sustained very nicely if they are placed in the inverted position and permitted to take liquids through a tube.

Operation.—The first and most important condition to be secured in order to make a satisfactory intubation is perfect rest and quietude of the patient.

If a patient is able to move about even a slight amount it will be difficult to insert the tube without causing injury to some of the parts. To secure the child so that it cannot move it is best to take an ordinary sheet, have the child's arms placed alongside the body, and then wrap the sheet around and around a number of times so that the arms cannot be removed from the sheet. In attempting to move the arms the child will pull both ways at the same time and the result will be that it will not move at all. The child should then be taken upon the lap of an assistant, its head should be held against the left shoulder, the left arm of the assistant should pass across the lower portion of the child's chest, while the right arm should hold its head firmly against his shoulder. In this way the child can be held perfectly still. The gag is then inserted between the teeth and held by a second assistant who stands behind the one holding the child. The surgeon then inserts the first finger of the left hand into the mouth, lifts the epiglottis upwards and holds it in this position while he carries the tube mounted upon the applicator into the mouth and along the inner side of the index finger. This will guide it directly into the larynx. It is pushed down into the larynx gently and then released from the applicator by the mechanism provided for that purpose. At the same time the index finger is placed upon the tip of the tube and the latter is driven down so that the rim at its upper end rests upon the broad surface of the vocal cords. The applicator is in the meantime withdrawn quickly and this will enable the child to breathe through the tube.

It is wise to leave a firm, silk thread attached to the intubation tube and to have this passed out through the angle of the mouth and fastened upon the cheek by means of rubber adhesive strips. In this manner the removal of the tube can be accomplished by the nurse in case it should become occluded during the absence of the surgeon. Since the introduction of antitoxin it has been necessary to leave the tube in place only from one to three days, at the end of which time its removal has usually left the larynx sufficiently free to permit of breathing without the further introduction of a tube.

LARYNGOTOMY.

The presence of a foreign body in the larynx underneath the vocal cords, which cannot be forced out of the larynx by the efforts of the patient and which cannot conveniently be reached through a tracheotomy wound, sometimes necessitates the splitting of the larynx. The same operation is occasionally indicated in the presence of benign growths located underneath the vocal cords.

The important point in this operation consists in the thorough anæsthetization of the interior of the larynx by means of a spray of a four per cent. solution of cocaine in water. The patient is placed in the Trendelenburg position with the head dependent over the end of the table. An incision is made in the median line extending from a point an inch above the prominence of the thyroid cartilage to a point opposite the isthmus of the thyroid gland. This incision is carried down to the larynx, care being taken to grasp all of the blood vessels at once. Just before opening the larynx the cocaine spray should again be applied, it having been thoroughly applied just before beginning the operation. Then a sharp tenaculum is inserted on each side of the median line and while an assistant makes gentle traction upon these tenaculæ a longitudinal incision is made through the larynx. As soon as the larynx has been opened there is usually a violent attack of coughing unless the larynx has been thoroughly cocainized. If a foreign body is lodged in the larynx the first effort of coughing usually forces it out, and the same precaution should be taken which was mentioned in connection with tracheotomy for the removal of foreign bodies in the trachea. An assistant should be ready to sponge away any mucus that is forced out by the first effort of coughing, because this is likely to contain the foreign body.

In case the operation has been performed for the removal of a growth the larynx should again be sprayed with cocaine after it has been opened in order that the operation may not be interrupted on account of coughing which is due to an irritation of the mucous membrane lining the larynx. The diseased portions can be so perfectly exposed that their removal is not connected with any difficulty. Hæmorrhage is controlled in the usual way, and after the operation has been completed the wound is closed by means of deep and superficial sutures. The deep sutures should not enter the larynx.

LARYNGECTOMY.

In the presence of malignant growths which are confined to some portion of the larynx its removal is indicated if the surgeon can be fairly certain that there has been no secondary involvement.

The same preparations that have been mentioned in connection with laryngotomy should be practised in laryngectomy. If there has been a sufficient amount of obstruction to the entrance of air for a considerable time before the patient comes under the care of the surgeon to greatly reduce the strength of the patient a preliminary tracheotomy should be performed so that the patient's general condition can be improved before the radical operation is performed. If the obstruction is not sufficient to seriously interfere with the patient's breathing then it is just as well to perform the operation at once without having made a preliminary tracheotomy. The operation should again be performed with the patient in the Trendelenburg position with the head dependent over the end of the table in order to prevent the entrance of blood into the trachea.

An incision is made from a point an inch and a half above the prominence of the thyroid cartilage to a point just above the sternum. The vessels overlying the larynx and trachea are carefully caught with hæmostatic forceps and cut. The isthmus of the thyroid gland is grasped between two pairs of hæmostatic forceps, cut and ligated. After the larynx and the trachea have been carefully laid bare a tenaculum may be inserted into the third or fourth ring of the trachea and the latter cut off transversely. It is then rapidly drawn up and loosened so that its upper end faces forwards and acts as a curved tube communicating with the anterior surface of the neck. It is dissected loose sufficiently to project half an inch beyond the margin of the skin, which is buttonholed a short distance below the lower end of the incision, so that the end of the trachea may be drawn through. This will aid in preventing the discharge from the wound from entering the trachea and causing aspiration pneumonia. It is then sutured in place by means of several fine sutures which extend through the third or fourth ring of the trachea. The upper portion of the skin incision is left open to facilitate the remaining steps of the operation necessary to remove the larynx. In this manner the patient is enabled to breathe without the danger of inspiring blood. It is also possible by placing the anæsthetic upon a piece of gauze held over the end of the trachea to continue the anæsthesia without annoyance.

The larynx is now carefully dissected out, beginning from below and loosening both sides simultaneously and controlling the hæmorrhage step by step by means of hæmostatic forceps and ligatures. It is well to keep the larynx and the trachea cocainized in order to prevent the annoyance which is due to coughing. When the upper end of the larynx is reached care should be taken to cut its attachment in the pharynx so that the latter can be closed by means of sutures. If the pharynx is already involved in the malignant growth the removal of the larynx is practically useless and a simple tracheotomy will be of quite as much benefit to the patient; consequently in cases which are proper for the removal of the larynx these flaps can be formed without fear of leaving portions of the carcinoma. The pharynx is then carefully closed, preferably with two rows of sutures, a piece of iodoform gauze is carefully tamponed underneath the wall which has thus been formed in order to provide drainage in case a leakage should occur. The remaining portion of the wound is then carefully sutured by means of deep and superficial sutures. It is usually not necessary to insert a tracheotomy tube in a trachea which has been brought out in the manner just described. The skin should be carefully sutured above and below, and it is well to protect the wound against infection from the mucus which will be expelled from the trachea by the application of some oily substance, such as vaseline. The dressing must necessarily be small in order that the entrance to the trachea be not obstructed in any way. The same precaution should be taken against irritation from the direct introduction of air into the trachea that was mentioned in connection with tracheotomy. A frame covered with gauze should be fastened over the opening and kept moist by the application of a small amount of normal salt solution. As soon as the wound has healed an artificial larynx should be fitted into the trachea. It is claimed that a sufficient amount of air can be retained in the pharynx to give an audible voice sound, making the use of an artificial larynx unnecessary.

Surgery of the Mouth.

EXCISION OF THE TONGUE.

Carcinoma of the tongue is not very uncommon and fortunately it is frequently amenable to surgical treatment, the prognosis being favorable in quite a considerable proportion of cases. If the portion involved is confined to the anterior half of the tongue its removal is quite simple. The tongue is drawn out of the mouth, is transfixed at its base with a needle armed with a strong double silk suture; the tongue is tied in halves, considerable force being used in order to prevent the possibility of hæmorrhage during the operation. A second strong silk suture is passed through the tongue just above the insertion of the first; with this the tongue is drawn forward. Then the diseased portion is cut away, leaving just enough beyond the silk ligature to permit the suturing of the two halves of the tongue in the median line. Upon inspecting this surface the blood vessels on the lower surface near the median line can readily be discovered. These are caught in hæmostatic forceps and ligated separately. A row of sutures is then applied, bringing the two halves of the cut edge of the tongue in accurate apposition. These sutures are carefully tied and then the silk sutures are cut. The second silk suture which was applied is left in place for twenty-four or forty-eight hours in order to prevent the tongue from falling back into the pharynx. This accident happens very rarely, but if it does occur it is very troublesome unless some provision is made for holding it forward.

The submaxillary lymphatic glands and the cervical glands in front of the deep jugular vein are most likely to be involved secondarily in this condition, and if the disease is at all advanced it is wise to make an incision on each side and remove these glands, even though it may not be possible to palpate them through the skin. If the disease extends to the posterior portion of the tongue,

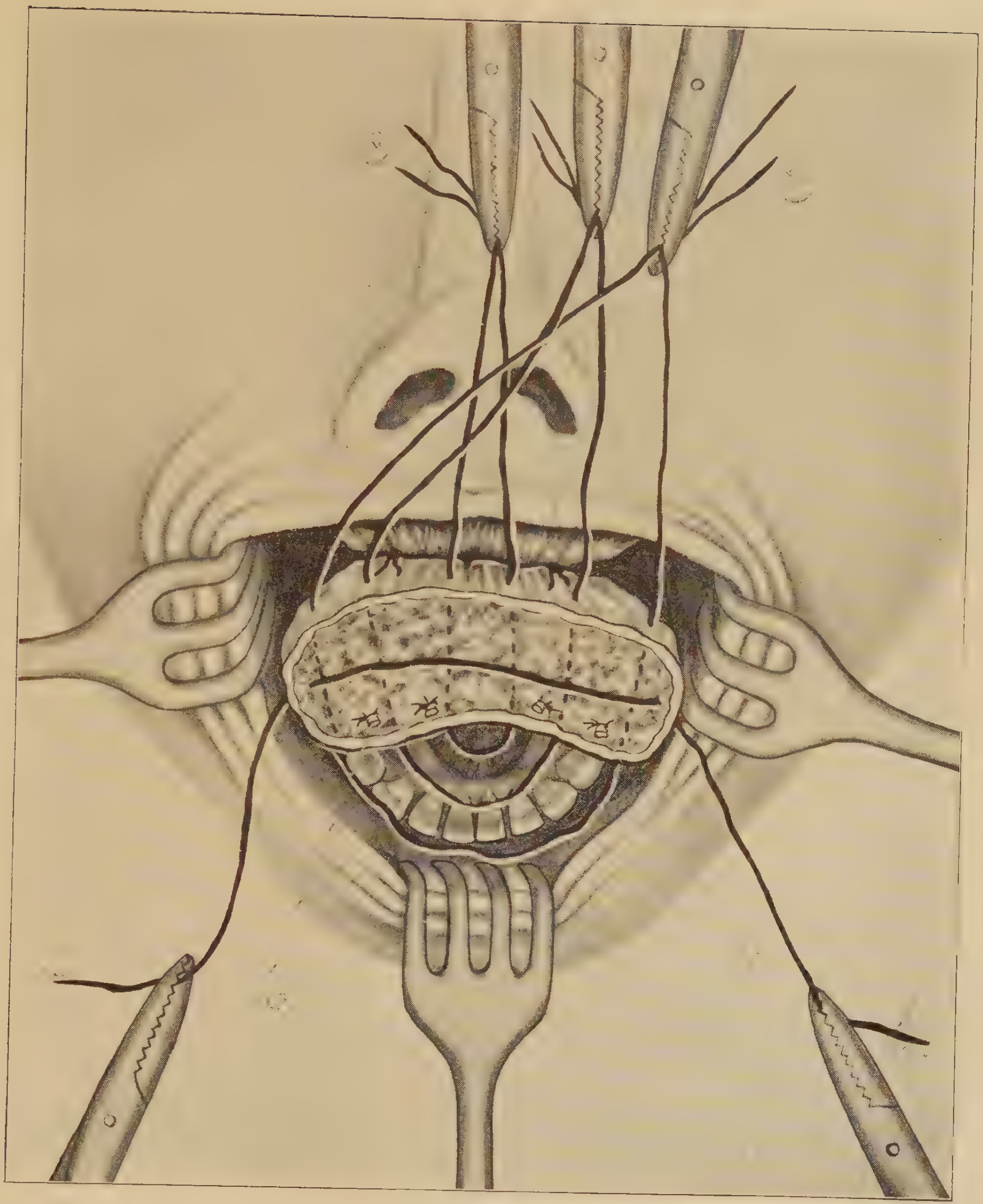


PLATE LVIII.

EXCISION OF TONGUE.

This plate shows the base of the tongue compressed by two strong silk ligatures which have been applied by passing a needle armed with a double ligature through the center of the tongue and tying in halves. These ligatures are removed after the diseased portion of the tongue has been cut and the vessels at (aa) have been separately ligated and the sutures (bb) and (cc) have been inserted.

When the temporary ligatures are cut traction is made upon the suture (bb), which will bring the lateral flaps into apposition. Then the sutures (cc) are tied and then (bb) and the mucous membrane is closed by a continuous cat-gut suture.

either on one or both sides, it is best to make a temporary ligation of the external carotid artery before beginning the operation. This can be accomplished most readily by laying bare the artery at its origin on each side and applying a pair of clamps which have been constructed for this purpose. These clamps should not be sufficiently strong to cause any injury to the vessel, but just strong enough to prevent the passage of blood through it. The jaws of the instrument should be covered with drainage tubes to prevent the crushing of the vessel walls. The operation is thus rendered practically bloodless and can be accomplished with great thoroughness. The larger vessels should be caught in hæmostatic forceps and ligated separately and then the stump which is left should be carefully closed by means of a sufficient number of sutures to prevent oozing. After the entire surface has been carefully covered the forceps are loosened first on one side and then on the other. In case hæmorrhage occurs they can be compressed again and the bleeding controlled by the further application of sutures.

With this location of the growth there is still greater likelihood of invasion of the cervical and the submaxillary lymphatic glands, and in such instances their removal is always indicated, although it may not be possible to palpate them through the skin. In case the floor of the mouth is involved together with the tongue, the same preliminary compression of the external carotid should be made, but in order to make a complete removal of the tissues it is wise to split the lip and the lower jaw through the middle down to a point just above the thyroid cartilage, to insert retractors in each segment of the jaw, and to open the entire space by careful continuous dissection. In this way the entire floor of the mouth and the base of the tongue can be perfectly exposed. The larger blood vessels are caught and ligated successively.

The excision of the tongue is performed as described above and if there is any mucous membrane left after the entire growth has been freely excised this is utilized for the purpose of lining the floor of the mouth. After this operation the forceps upon the arteries should be loosened before the jaws are united in order that all of the hæmorrhage may be carefully controlled. After this has been accomplished the two halves of the jaws are united by means of chromicized catgut sutures. The floor of the mouth is drained through the lower end of the incision and the remaining portion of the wound is carefully closed.

This method provides a very perfect exposure of the field of operation, but it is, of course, very much more severe than the operations which have just been described, and I believe that it is indicated only in cases in which there is involvement of the floor of the mouth.

RANULA.

In operating for the relief of ranula the object to be attained is either to establish a new communication between some portion of the ducts of the sublingual glands involved and the cavity of the mouth, or the complete removal of the entire gland. The simplest method to re-establish a connection between the ducts of the gland and the cavity of the mouth is through the use of a seton. By applying a large-sized silk suture transversely across the ranula and tying this loosely so that it does not have a tendency to cut away the intervening portion of the mucous membrane, one can frequently secure the growth of epithelial cells in these openings through which the silk suture passes so that the lining of the duct and the cavity of the mouth become continuous. After this has occurred at both the point of entrance and exit of the suture a new suture may be introduced through the same openings and tied more tightly so that the intervening tissue may become absorbed slowly. The opening formed between the cavity of the ranula and the mouth will thus become continuously lined with mucous membrane and presently a permanent opening will be established. This, however, will not occur in every case and it may become necessary, later, to remove a considerable portion of the tissue between the cavity of the mouth and the ranula, to sponge this cavity dry, and to cauterize it either with the actual cautery or with strong carbolic acid, followed after a few minutes with strong alcohol or by the use of some other caustic, and then by the application of a tampon of iodoform gauze to the cavity thus formed. In a number of cases none of these methods will succeed and then it may become necessary to dissect out the entire gland in order to prevent recurrence. Unless the ranula has been severely inflamed it is usually possible to find a line of cleavage and to peel out the mass in a manner very similar to the method described in the removal of a branchial cyst. It is necessary to drain this cavity because its communication with the cavity of the mouth is likely to prevent preliminary healing.

SUBLINGUAL CYSTS.

Occasionally a dermoid cyst is found in the region of the hyoid bone which may be mistaken for a ranula. It will occasionally be differentiated from a ranula by the presence within the cavity of some epidermal structures, such as hair or teeth. The diagnosis is usually not made until these structures are encountered because of the much greater frequency of the presence of an ordinary ranula.

Treatment.—It is, of course, clear that nothing but the complete excision of this growth will accomplish anything. There is usually a line of cleavage which can be followed and the growth can be peeled out with little difficulty, unless there has been a chronic inflammation causing extensive adhesions. It is necessary to take especial care in dissecting out this growth at the point of its attachment to the hyoid bone because it is at this point that one is likely to leave a small portion which will give rise to a recurrence.

EXCISION OF TONSILS.

In this climate a large proportion of children and young adults suffer from the presence of hypertrophied tonsils, a condition which is very commonly complicated with the presence also of adenoids in the post-nasal space. This condition is exceedingly harmful, because it prevents the patient from performing the functions of respiration normally. The amount of air which is permitted to enter the lungs with each inspiration is greatly reduced unless the mouth be kept open, and in that case the patient suffers from the inhalation of impurities which would be removed from the air by its passage through the nostril, and by inhaling the air which has not been modified either in temperature or moisture.

In many children there is a marked contraction of the chest due to this condition, and although the obstruction may later be removed the lung capacity can scarcely be fully attained because of the deformity which already exists.

The tonsils and post-nasal adenoids are also very likely to become infected with various pathogenic micro-organisms, the most common acute forms being those of the ordinary pus microbes, the diphtheria bacilli, the micro-organisms of influenza and the pneumonia diplococcus, while a large proportion of these patients suffer from the infection with tubercle bacilli. In this way the patient constantly carries about a dangerous septic focus. In many of these cases the infection from the tonsils and adenoids extends into the Eustachian tubes and gives rise to deafness, or it advances into the middle ear through the Eustachian tube, giving rise to suppurative inflammation of this cavity, which may further result in an infection of the mastoid cells. It is not uncommon, moreover, for the infection to become acutely increased, giving rise to tonsillar abscess or to an infection of the deep tissues of the neck.

The infection of the lymphatic glands of the neck has already been mentioned. There is scarcely another circumscribed area in the body from which so many secondary infections proceed as from the tonsil. It is one of the most common sources of cryptogenetic infection, and frequently responsible for acute osteomyelitis. So long as this organ is normal there can be no doubt but what its lymphatic structure enables it to destroy a great number of pathogenic micro-organisms, but after it has once become diseased and filled with these micro-organisms their presence is a menace to the health of the entire body.

Treatment.—The indication for treatment is plain in every case in which any of the conditions which have been mentioned exist. The portion of the tonsil which causes the obstruction, and which contains the septic material, should be removed. This can be done very easily and safely by means of any one of a number of instruments which have been especially constructed for this purpose, or it can be done by grapsing the tonsil with a pair of volsellum forceps and cutting away as much as desired by means of a sharp scalpel or by means of a pair of sharp, long-handled scissors. It is wise to anæsthetize the mucous membrane by spraying the surface with a four per cent. solution of cocaine, in order to make the operation less painful. If a tonsillotome is used, it should be applied from below upward and from behind forward.

Dangers of the Operation.—Unless the tonsil is acutely inflamed, in which case the operation should be postponed, there is but slight danger from hæmorrhage. If the organ is drawn too tightly into the cavity of the pharynx before it is cut off the tonsillar artery sometimes bleeds considerably. For the purpose of controlling this hæmorrhage I have found the following mixture most useful: A teaspoonful of acetanilid, a tablespoonful of alcohol and about two ounces of water are mixed and used as a gargle. This usually stops the hæmorrhage almost instantly. If this does not suffice pressure made with a sponge held at the end of a pair of forceps for a period of five minutes will usually be efficient. Should this also fail it is well to insert a cat-gut stitch about the base of the tonsil and to tie this just firmly enough to stop the hæmorrhage. There is an instrument constructed with two padded branches, one of which is inserted into the mouth and placed directly upon the bleeding tonsil, and the other one is placed at a point opposite on the outside of the neck. When this instrument is closed it makes a sufficient amount of pressure on the tonsil to stop the bleeding. In over one thousand tonsillotomies that I have personally made, I have never been compelled to use any of these methods except the gargle with acetanilid, alcohol and water, although in one instance I had quite a severe fright in a patient who was a hæmophiliac and belonged to a hæmophilitic family, a fact which had escaped my observation.

After Treatment.—The patient should be given some mild antiseptic gargle, which should be used mornings and evenings for a number of months following the operation, in order to improve the condition of the mucous membrane of the pharynx. In these cases it is usually wise at the same time to curette away the post-nasal adenoids by means of a flat curette with the cutting edge at right angles to the handle and directed away from the handle. The instrument known in the market as the Gottstein curette is most useful for this purpose. The first finger of the left hand should be inserted above the uvula, and with the right hand the adenoids should be curetted away with a few quick motions. If the patient is anæsthetized for this purpose he should be placed in the inverted position with the head dependent from the end of the table. After this has been done an ordinary small, semi-sharp curette should be introduced through the nostril, and with the finger still above the uvula to guide the spoon, the slight remnants of the adenoids which have not been removed with the flat curette should be carefully scraped away. Then a piece of dry gauze, doubled upon itself about four times, is introduced on the end of the finger, and with this the entire space is thoroughly rubbed, so as to remove any small portions that may still be present.

It is important that all patients who have suffered from the presence of hypertrophied tonsils and adenoids should be given careful instruction in breathing exercises. They should be taught to inhale fully through the nose, with the lips closed, so as to expand the chest to its fullest extent, being sure to make use of the diaphragm in this exercise. They should then force out the air—resisting with the lips—or, better still, they should blow through a small tube, with an opening about two millimeters in diameter, until the lungs have been emptied as much as possible. This exercise should be repeated about twenty times every morning and evening. It is remarkable how greatly these patients can be benefited by this simple exercise.

Concerning the operation of tonsillotomy, I wish to emphasize the fact that the operation is greatly facilitated by having the patient's head held perfectly firm between the hands and against the chest of an assistant, if the patient is not under the influence of an anæsthetic. It is wise in this case to have the patient hold his arms along his sides and to wind an ordinary bed sheet around his shoulders several times, so that he cannot interfere in the operation. An adult not under the influence of an anæsthetic should be seated in a firm chair, and an assistant should stand behind him and place one hand on each side of his head and force the head against his chest, so that the latter is held on three sides. Children are best held by seating them in the lap of an assistant, who takes their limbs between his knees and holds the child in the manner described for performing intubation.

In using the tenaculum forceps and scissors, or scalpel, it is necessary to apply a gag between the teeth of the patient. This is also necessary in the use of some tonsillotomes, while with others it is possible to operate without this because the tonsillotome itself prevents the teeth from closing.

CLEFT PALATE.

The success of this operation depends largely upon the thoroughness with which the flaps are loosened. If the surgeon appreciates the fact that his operation is not likely to succeed so long as there is any tension upon the stitches which unite the edges of the wound in operations for the relief of cleft palate, he has grasped the most important principle in this operation. The method of the operation will vary with the extent of the cleft. If this is only through the soft palate, it is wise to split the edge of the cleft throughout its entire extent, beginning at the end of the tip of the uvula on one side, extending this incision around the entire cleft to the tip of the uvula on the other side. This produces a broad surface for coaptation. It is necessary to make use of an exceedingly sharp scalpel in order to accomplish this incision satisfactorily. After this has been accomplished, a method must be adopted for loosening the flaps on either side so thoroughly that they will come together without the slightest tension. This can be brought about by making two lateral incisions along the outer edge of the palate and loosening the soft tissues by means of an elevator, or a small chisel may be applied to the alveolar process of the palate bone and this may be chiseled off, as shown in Plate LIX.

It matters little how large an incision or an opening is made upon each side, provided the flaps can be sufficiently freed so that they will come together without injury. The lateral incisions will invariably heal spontaneously.

In case the cleft extends into the hard palate, or through the hard palate, the following method has been most satisfactory in my hands, although it is more troublesome than some of the other procedures that have been found equally useful by other surgeons. The incision is made under the alevolar process on each side. A broad, thin chisel is placed in this incision and the horizontal portion of the palate is chiseled away so that there is a perfectly loose flap consisting of mucous membrane of the mouth, the bone of the palate and the mucous membrane of the nasal cavity attached only in front and behind. If one side or the other is attached to the vomer this attachment is also loosened. If this flap is made so loose on each side that it can be carried over to the flap on the other side without the use of any force, then one can usually count on a successful result.

The hæmorrhage in this operation is considerable, but it can readily be controlled by means of a tampon. The patient is in the Trendelenburg position with the head projecting beyond the table, consequently there is no danger of the inspiration of blood. After these flaps have been made the fissure which has been formed under the alveolar process should be thoroughly tamponed with iodoform gauze and the flaps should remain undisturbed for one or two weeks, the nose and mouth being frequently irrigated each day with normal salt solution. At the end of this time the flaps are usually very vigorous and readily heal if the edges are freshened in the manner I have just described in connection with operation for cleft of the soft palate.

The most satisfactory suture material in my practice has been horse-hair, because it is slightly elastic and stretches sufficiently to prevent pressure necrosis. Of course it is necessary not to tie these sutures tightly because the same elasticity which would be useful if these sutures are tied loosely would then become harmful because it would increase the amount of pressure necrosis precisely after the manner of an elastic ligature. It is well to remember that the fewer the number of sutures that will suffice to secure perfect apposition the greater will be the likelihood of union.

In order to hold the bony portion of the flaps in position it is well to pass around them one or two stitches of silk worm gut, which should be tied just tightly enough to hold the tissues together and not tightly enough to cause pressure necrosis, because

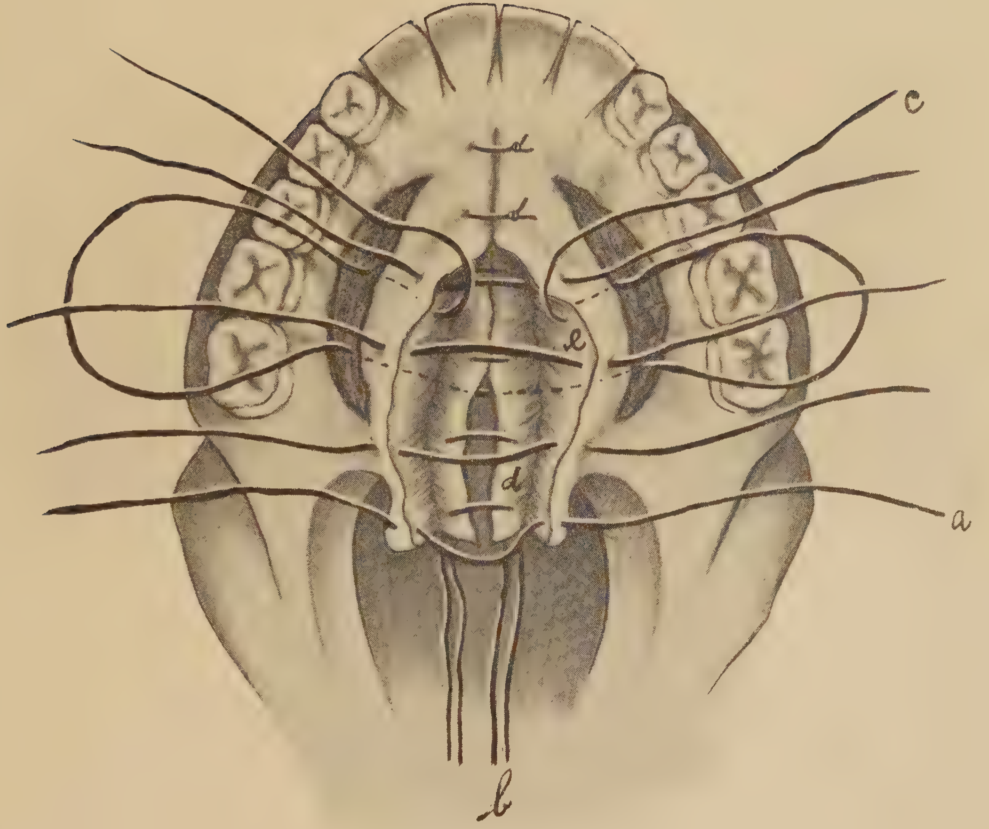


PLATE LIX.

CLEFT PALATE OPERATION.

(a) Shows sutures on mucous membrane turned into nasal cavity; (b) sutures on flap turned into the cavity of the mouth; (c) the silkworm gut suture which holds together the bone flaps; (d) flap turned into the nasal cavity; (e) flap turned into cavity of mouth; (f) incision through hard palate. In order to make the conditions clear the drawing was made to represent only the lower surface of the upper jaw with the hard and soft palate.

the latter condition is likely to result in a complete severing of one or both bony flaps. The fissures under the alveolar process should again be carefully tamponed with iodoform gauze. If the fissure extends through the alveolar process in front, this should be mobilized on either side some distance back from the fissure by means of a chisel applied between the teeth, and then the edges should be united at the point of fissure by means of a catgut suture.

In children who are not old enough to remain perfectly quiet during the removal of the stitches it is best to administer an anæsthetic when the stitches are removed, for fear of disturbing the line of union. If possible the sutures should be removed on the fifth or sixth day, because if they are left longer they sometimes result in sloughing.

Nothing has been said so far concerning the age of the patient to be operated because I am not certain that my own practice is the best in this respect. It is my custom to close only the fissure in the alveolar process in children before the age of two years and to leave the remaining portion of the cleft until the time when the child begins to talk or makes attempts at talking. I also caution the parents of such children against encouraging them in these attempts, because it has seemed that my results have been more satisfactory when I have taken the cases at this age than when I have attempted the operation in very young children; moreover, the mortality in children at this age has been practically nothing, while in younger children it has been considerable. In older children it is difficult to secure perfect speech unless great pains is taken in giving them instruction. The following observation, however, has convinced me that it is possible to get these children to speak very nearly perfectly if a sufficient amount of care is employed. If children should have learned a given language before the operation was performed and have later learned another language, I have found that the language which they learned later was spoken perfectly, while the defects practised in the language learned before the operation were likely to persist. It is consequently plain that if these children were taught to relearn their language that with care they could accomplish a great deal. This I have found to be true in practice and I would consequently advise a systematic course of instruction in the formation of those sounds in the utterance of which the soft palate is involved. Some especially gifted teachers have succeeded in producing perfect results whenever the child has possessed a sufficient amount of intelligence to appreciate the instruction and the necessary perseverance to carry it out.

FISTULÆ FOLLOWING OPERATION.

It happens occasionally that a fistula remains in some portion of a wound which has been sutured. This may be due to the cutting of a stitch or there may have been a certain amount of tension which prevented union, or there may have been a slight amount of infection. If these fistulæ are painted every day with tincture of cantharides they are likely to unite very rapidly. If they fail to unite after this has been tried for several weeks it is best to leave the fistula for a number of months until the surrounding tissues have become quite normal and then to make a longitudinal incision on each side of the fistula and to loosen enough of the soft tissue to permit the two sides to come together in mid-line without any tension. These incisions should be long enough to make the flaps perfectly free. Then the fistula is freshened and united by means of a stitch. Occasionally it seems better to make a horseshoe-shaped incision around one or the other end of the fistula and thus to loosen a one-sided flap which will heal directly over the opening.

HARELIP.

This subject has been virtually settled for so long a time that I would not mention it in this work were it not for the fact that a few fundamental principles are constantly overlooked in performing the operation and because of this the results have been in many cases most unsatisfactory, leaving the patient with a very ugly lip.

In the first place the surgeon should bear in mind a most important principle which applies to all operations for the relief of deformities, namely, that the deformity must be over-corrected in order to be sufficiently corrected. One must expect in all of these cases to lose a certain amount after the healing has taken place, and provision must be made for this inevitable loss.

2nd. There must be no tension upon the flaps, for this will result in pain and consequent restlessness of the child, and is likely to result in the cutting through of some of the stitches. There is very little harm in loosening the cheek to a point very near the eye in order to secure a loose flap. This has the further advantage of lifting the nostril and overcoming the flattened condition which is present in these patients.

3d. The depth of the lip can be increased by transverse incisions.

4th. The thickness of the lip is secured by suturing the mucous membrane and the skin separately and using the through-and-through sutures simply as stay sutures.

5th. The thickness is further increased by tying all the sutures just firmly enough to bring the surfaces together and not firmly enough to cause any pressure necrosis. Horse-hair is the best suture material, because it cannot be tied very tightly without breaking, and if tied loosely its natural elasticity will be of great value when the œdema occurs. In performing an operation for harelip in cases in which the intermaxillary portion of the jaw projects forward beneath the nose, it is important that this be carefully replaced. A triangular piece should be cut out of the vomer, the ends of the intermaxillary portion should be cut, and the ends of the jaws at the point of the cleft should also be deprived of the covering of mucous membrane; then the intermaxillary portion should be fastened in place by means of a catgut suture on each side. This will aid greatly in improving the appearance of the child and do much to give a satisfactory upper jaw.

I have said nothing concerning the formation of the flaps because there is little difference in the method chosen, provided the principles laid down above are adhered to. In double harelip it occurs that the child has difficulty in breathing after the operation because the nostrils are closed. This can be overcome by inserting a small rubber tube in each nostril, which is to be cleansed and replaced frequently. Care should be taken in this operation to have the edge of the mucous membrane and skin on each side of the cleft in the lip accurately adjusted so that the red rim of the lip will be continuous and uniform. If it becomes necessary, notwithstanding the fact that the flaps have been freely loosened, to make use of tension sutures to relieve the coaptation stitches these should be applied and tied from the mucous side and should not be permitted to enter the skin in order to avoid the production of scars.

Age of the Patient.—If the operator is reasonably rapid in his work so that the child will be exposed to the traumatism for only a few minutes, it is best to operate upon these children as soon as possible after they are born. The results are more perfect and the children will usually be enabled to nurse within a few hours after the operation has been accomplished. With a slow operator, however, it is best to wait until the child has gained a sufficient amount of strength to withstand the traumatism during the time the operator will require for performing the operation.

By placing tension upon the flaps as they are made the amount of hæmorrhage can be reduced to the minimum, so that nothing need be feared from this cause.

TUMORS OF THE LIP.

Angioma.—Angioma is the most common of all tumors in the lips of children. The growth appears as a little purple mark usually not larger than the head of a pin. This will increase in size in time until it involves the entire lip. Later, it will extend over the face so that quite a portion thereof may be involved. After attaining some development this growth is likely to vary in size with differences in the temperature of the air in which the patient exists. While out of doors in the cold it will decrease so that it can scarcely be noticed, but when the patient is in a warm room it may increase so as to be quite troublesome.

Time for Operation.—Angioma of the skin in this vicinity, as in every other vicinity, should be removed at once as soon as the diagnosis is made, because its removal is a very simple matter in the early part of its development, while later on it may involve the reduction of a considerable deformity. So long as the growth is very small, not larger, for instance, than one or two millimeters in diameter, a simple puncture with a needle heated to white heat or with the fine knife of the electro-cautery or the fine point of a Paquelin cautery, will suffice to destroy an angioma permanently. If the growth has developed to a larger size it is best to excise it and to suture the wound so that the scar will be in the least offensive position.

Epithelioma.—Epithelioma of the lip occurs most commonly in the lower lip in the male. Its removal is indicated at the time when it is first noticed. The removal should always be extensive, at least half an inch of perfectly healthy tissue should be excised in every direction. The incision should be at right angles to the edge of the lip and there should be a transverse incision joining the two vertical incisions. All of these incisions should extend entirely through the lip. The transverse cut should extend beyond the vertical incision to about one-fourth the distance between the two vertical incisions, so that there is a flap on each side which can be brought to meet its fellow and then the transverse incision can be sutured to the lower edge of these flaps. A very considerable amount of the lip can be removed in this manner without leaving any deformity to speak of. If the entire lower lip is to be removed the defect should be closed by means of a plastic operation.

In epithelioma of the lip the submaxillary lymphatic glands and the cervical glands lying anteriorly to the sterno-cleido-mastoid muscle and externally to the deep jugular vein are the ones which are most likely to be involved. If the epithelioma is at all advanced these glands should always be exposed and removed.

Of late we have subjected all of these patients to prophylactic X-ray treatment after the operation. Whether this will prove a proper course to pursue must be determined by further experience.

PROGNOSIS.—With a thorough operation performed reasonably early in these cases the prognosis is very good.

Surgery of the Face.

EPITHELIOMA OF THE FACE.

What has been said regarding epithelioma of the lip applies to epithelioma of any portion of the face. The excision should be as early as possible. It should be very liberal and the defect caused should be covered by means of a plastic operation so that the resulting scars will interfere as little as possible with the appearance of the patient. Especial care should be taken to avoid tension upon the eyelids because this will result in an irritation of the conjunctiva, which may lead to serious trouble. By suturing wounds in the vicinity of the eyelids transversely tension of the lids can usually be avoided.

During the past year we have subjected a number of these patients suffering from epithelioma to X-ray treatment before subjecting them to operation; and we have found that perfect recovery without operation as the result of the X-ray treatment is not at all uncommon.

TUMORS OF THE JAW.

The most common tumor of the jaw affects the alveolar process. It begins as a hard, fibrous mass near the root of a tooth which progresses into the substance of the jaw, the tooth becoming loosened, and may develop a growth of considerable size. Presently it advances along the mucous membrane of the mouth and later it may extend into any of the surrounding tissues. During the early part of its development this tumor is composed of only fairly developed connective tissue cells. As it advances these become more and more embryonic until the growth has the appearance microscopically of a spindle-celled sarcoma. If it is partly removed its growth seems to be greatly stimulated, and if removed incompletely several times it will progress in the usual course pursued by a sarcoma.

TREATMENT.—One or two teeth should be extracted beyond each end of the growth, the entire alveolus should then be chiseled away deeply and the soft tissues covering the jaw should be removed together with the bone. Then the entire area should be thoroughly cauterized either with a Paquelin cautery or with a cautery-iron of considerable size which has been heated to white heat in a flame. The thorough destruction of the deep tissues by means of the cautery seems to be the important part of this operation. If this is done reasonably early these growths practically never recur.

DENTIGEROUS CYSTS OF THE JAW.

The retention of the embryonic teeth within the jaw gives rise to the formation of a bone cyst. It is frequently difficult to differentiate this from sarcoma except through the history, although the cyst wall usually yields under pressure with the finger placed upon the inner side of the jaw giving rise to a crackling sensation. The patient frequently observes the presence of a swelling for months or years before the physician is consulted. Were he suffering from a sarcoma there would be secondary involvement long before this time. During the early part of the development of a cyst of the jaw, however, it is not possible to make a positive diagnosis. There is always an unerupted tooth as the cause of this condition, but so few patients keep an accurate record regarding the number of teeth they have had extracted that one cannot make any reliable calculations from the number of teeth which are left.

TREATMENT.—The jaw is chiseled open either from below, an incision being made through the skin and periosteum and the latter reflected, or from the mouth, one or two teeth being extracted to make room for the operation. The cavity is carefully chiseled out, tamponed, and permitted to heal by granulation. Usually some remnant of the embryonic tooth is found. The prognosis in these cases is good.

SARCOMA OF THE LOWER JAW.

The only treatment that promises relief in sarcoma of the lower jaw is the excision of the entire half of the maxilla involved. This is accomplished by making an incision along the lower border of the jaw from the angle thereof to a point beyond the middle line of the chin. The soft tissues are carefully separated, the mouth opened, a tooth is extracted opposite the point at which the jaw is to be separated, and then a chain saw or a wire saw is carried around the bone, and while the wound in the skin is retracted in order to prevent its injury, the bone is sawed off. The end of the jaw is then grasped in a pair of lion-jawed forceps and carried out through the wound in the skin. If the tumor is located near the angle of the jaw it is best to remove the entire half of the maxilla, making an ex-articulation. This is accomplished by successively loosening the soft tissues, grasping the bleeding vessels that are encountered, and forcing the jaw outward, dislocating the joint and then cutting away the capsule. The only point at which one encounters any difficulty is the attachment of the styloid process, but with a little care and manipulation this can be loosened readily.

It is wise to grasp the facial artery and vein at the point at which they cross the lower jaw before cutting these vessels, because in this way the wound can be kept practically free from blood. A drain is inserted in the posterior and anterior angles of the wound. The mucous membrane is first sutured and then the skin is sutured up to the point of drainage.

In case any of the surrounding tissues have become involved these should be removed freely, but it is doubtful whether much benefit can come in these cases from an operation if the condition has advanced to the point of invasion of surrounding tissues.

RESECTION OF PORTIONS OF THE FACIAL NERVE FOR THE RELIEF OF NEURALGIA.

During the early portion of an attack of trifacial neuralgia, usually only one of the principal branches is involved. The most common one, in my experience, has been the submaxillary branch.

In all cases of trifacial neuralgia, without regard to the portion of the nerve involved, it is wise always to subject the patient first to carefully directed internal treatment. In a considerable proportion of these cases the condition seems to be due to an auto-infection from the alimentary tract. In these cases the daily use of from two to four ounces of castor oil given in the foam of beer will result in a permanent cure in at least one-half of all instances. At first the oil will act as a violent cathartic, but this property soon disappears, and after a few weeks the patient can continue to take this amount of castor oil daily without any disturbance of the bowels.

In the meantime these patients should be cautioned against the use of food which is likely to cause fermentation. Sugar should be prohibited entirely. Starchy foods should be limited, and acids should be used very sparingly. In case this and other forms of treatment fail to give relief to the patient the excision of a portion of the affected nerve is indicated. During the past few years a number of surgeons have advised the excision of the Gasserian ganglion for the relief of all facial neuralgias without regard to the branch involved. This seems, however, scarcely justifiable, because in many cases in which only a portion of the affected branch has been excised the patient has recovered completely and permanently; and if a complete recovery does not occur, it is still possible to perform a radical operation.

RESECTION OF THE INFERIOR DENTAL AND LINGUAL NERVES.

In my practice these two branches have always suffered simultaneously, so that I have never been forced to operate only upon one or the other. Both of these nerves can be approached conveniently through an opening in the lower jaw. An incision is made along the lower border of the jaw, beginning at a point a little behind the angle and extending forward an inch and a half. This incision is carried down to the bone. The periosteum, together with the attachment of the masseter muscle, is then pushed upwards by means of a chisel and an opening one-fourth of an inch in diameter is made exactly in the middle of the ascending ramus of the jaw by means of a small trephine or a gouge. This will expose the inferior dental nerve. The nerve is picked up with forceps and drawn out through this opening. Then a pair of hæmostatic forceps is placed upon the nerve and gentle traction is made forwards and downwards to loosen it as much as possible. A second incision is then made directly opposite the mental foramen. The mental nerve which issues from this foramen is readily found. It is picked up on an elevator and severed. The portion between the mental foramen and the trephine opening is then drawn out of this opening bv means of traction upon the foramen attached to this portion of the nerve. In this manner the entire portion of the nerve within the canal in the lower jaw is removed. Traction is then made upon this portion of the nerve and as much as can be drawn out of the foramen is cut off. A small, blunt hook is then inserted through this foramen and passed around the lingual nerve, which is drawn out through the trephine opening, caught with hæmostatic forceps, and as much as can be drawn out by pulling upwards and downwards repeatedly, is withdrawn through the trephine opening. It is then cut loose on the distal side and then the nerve is again caught with a pair of artery forceps, which are twisted slowly, so that the nerve is rolled upon the forceps like the rope upon a windlass. In this way a considerable portion of the nerve can usually be drawn out.

I believe that in my early cases I failed to remove a sufficient portion of each nerve, and consequently experienced recurrence in some of these cases, much more frequently than I have since performing this more thorough operation.

RESECTION OF THE INFRA-ORBITAL NERVE.

The infra-orbital nerve is the most common seat of trifacial neuralgia, according to statistics found in literature, but in my own personal experience it has been less frequent than in the inferior maxillary branch. The simplest method of approaching this nerve consists in making an incision along the lower edge of the orbit three-fourths of an inch in length, directly over the infra-orbital foramen, which can readily be located by making pressure along this margin of the orbit and determining the most painful point. Care should be taken to make this incision slowly, in order not to sever the infra-orbital artery at the point at which it issues from the foramen, because this will cloud the field of dissection with blood. The three branches—the supra-maxillary, spheno-palatine and infra-orbital nerves—usually do not separate before issuing from this foramen, but care should be taken in making the dissection not to overlook one or the other of these branches in case division has taken place before issuing from this foramen.

When the nerve has been laid bare it should be picked up on a dissector; and I would state here that the most convenient instrument for dissecting out nerves which I have encountered is the old-fashioned dental excavator, which is fine enough to serve properly and still contains sufficient strength to be useful. If the foramen is complete its upper portion is chiseled away, transferring it into a groove. The nerve is then grasped with a pair of hæmostatic forceps and drawn upward, and its branches are followed with a dissector and successively cut away at a distance of about three-fourths of an inch from the foramen. Careful traction, which is frequently repeated, is then made upon the nerve with the forceps. In this manner more and more of the nerve can be withdrawn.

If the neuralgia has been severe it is well to chisel away the upper wall of the canal with a blunt raspatory after loosening the periosteum overlying it. A narrow retractor is then inserted underneath the periosteum and while traction is made upon the nerve a narrow pair of scissors is inserted and the nerve is cut off a considerable distance from the infra-orbital margin.

EXCISION OF THE SUPRA-ORBITAL NERVE.

The operation which has just been described is performed for the relief of supra-orbital neuralgia with the exception of making an incision along the supra-orbital margin after shaving away the eye-brows. If the incision is made directly through the middle of the eye-brow, and parallel to it, it leaves no deformity.

These three operations are relatively simple and safe. They give rise to no deformity, and unless the antrum of Highmore is opened in chiseling open the infra-orbital canal the wounds all heal rapidly and perfectly. In case any one of these operations has been performed and there is a recurrence of the neuralgia the procedure can be repeated and a second attempt may result more favorably. If, however, a radical cure of the condition is desired, then it is best to excise the Gasserian ganglion.

REMOVAL OF THE GASSERIAN GANGLION.

Preparatory to this operation, provision should be made against the occurrence of an injury to the conjunctiva from the fact that the operation is accompanied with paralysis of this portion, which prevents the eyelids from protecting the conjunctiva against injury. The conjunctiva is protected temporarily by closing the eyelids by the application of a few fine silk sutures. These are removed at the end of from one to two weeks and then the eye is protected mechanically by the use of a properly adjusted shield. The next step consists in providing for a bloodless operation. This can be accomplished by exposing the common carotid artery and applying to it a properly constructed clamp, which will close the lumen of this vessel without crushing the intima. The pressure should be carefully graded, so that this object can be accomplished with certainty. This, however, is possible only in patients in whom arterio-sclerosis does not exist to a marked degree. The hæmorrhage comes partly from the middle meningeal artery and partly from the dura, and both of these sources are of course controlled by this temporary closure of the common carotid. A horseshoe-shaped incision one and one-half inches in diameter is then made with its convexity upwards, its

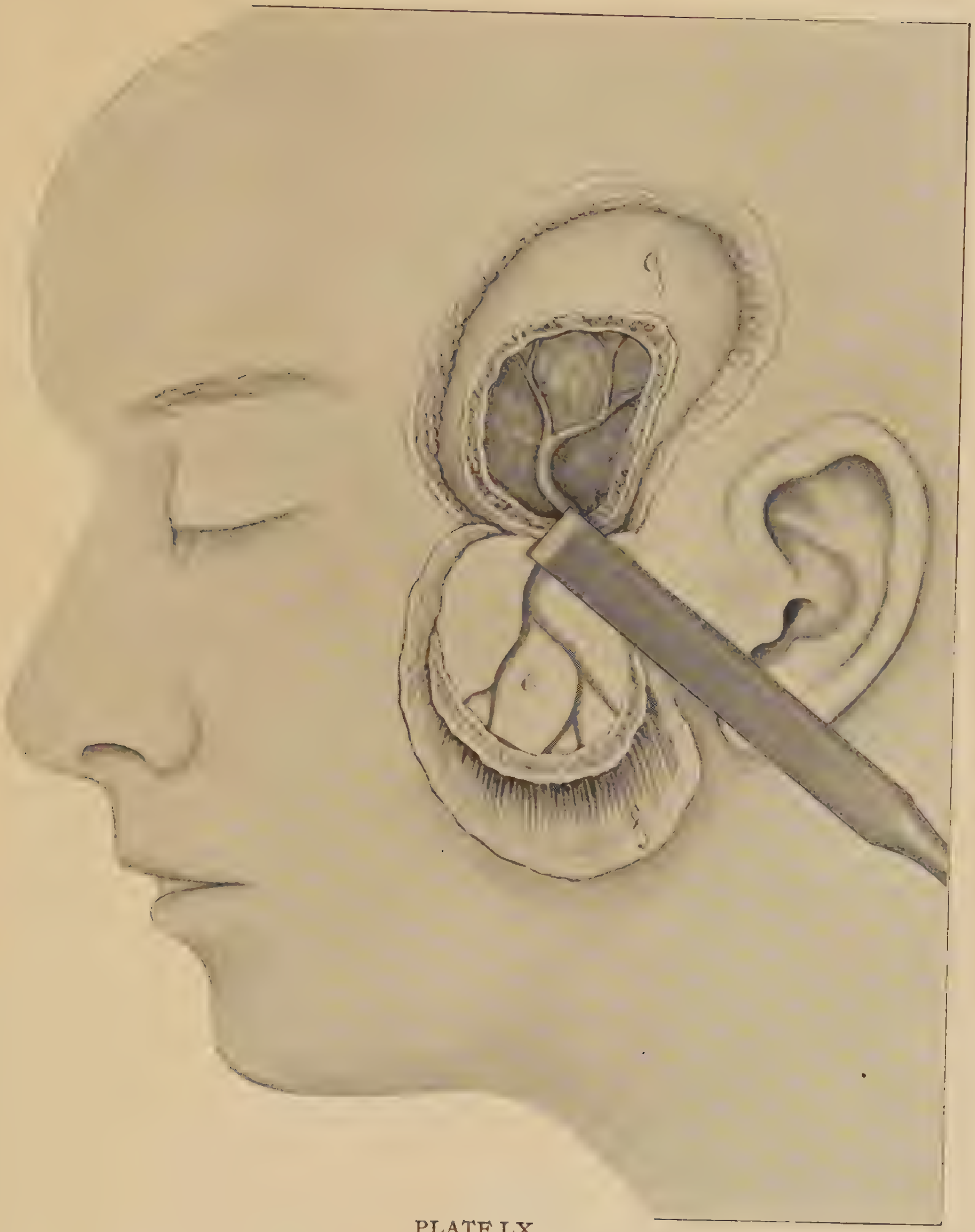


PLATE LX.

TEMPORARY RESECTION OF THE SKULL.

The eliptical flap of bone *a* remains attached to the flap of the skin, fascia, muscle and periosteum *f*. The latter is represented somewhat too large in proportion to the size of the bone flap. *b* shows the middle meningeal artery with its anterior and posterior branches *e* and *d*. The chisel *c* is in the position in which it was held for the purpose of severing the lower attachment of the bone flap after the horse-shoe shaped groove had been cut with the De Vilbiss forceps. The entire flap should be placed a little higher for the purpose of ligating the branches of the middle meningeal artery, and somewhat lower for the removal of the Gasserian ganglion.

lower branches being opposite the lower border of the zygomatic process, which is temporarily resected, the center of the flap corresponding to a point opposite the Gasserian ganglion. The trephine opening is then made similar to the one illustrated for the ligation of the middle meningeal artery and then by means of the DeVilbiss' forceps a groove is cut in the bone similar in shape to the skin flap, only slightly smaller. The base of this flap is severed by means of a few strokes of the chisel, and then it is elevated and laid downwards, exposing the dura. The portion of the zygomatic process which has been temporarily resected is carried down with this flap and increases the space very considerably. It is best to ligate the middle meningeal artery at once, because this can be done more conveniently before the tissues have been disturbed by the remaining steps of the operation. The dura is now carefully separated to the foramen ovale, then it is elevated between the foramen ovale and the foramen rotundum by means of a blunt instrument. The three branches and the root of the Gasserian ganglion are then elevated, care being taken not to approach the inner side of the Gasserian ganglion until the remaining portion of the isolation has been completed, because of the danger of injuring the cavernous sinus and thus clouding the field of operation for the remaining steps.

The second and third branches of the nerve are then severed and the Gasserian ganglion grasped by means of forceps and forcibly loosened from its attachment. In case there is still a considerable amount of oozing a warm, moist gauze tampon is applied and left in place undisturbed for at least five minutes. It is then slowly removed and the clamp upon the carotid artery is slowly loosened. If hæmorrhage occurs, which is not likely unless the middle meningeal artery has not been properly ligated, the clamp is again tightened carefully until the same ceases and the bleeding points are caught and ligated with fine cat-gut, if this is possible, otherwise a small iodoform gauze tampon is applied and held in place. This, however, is not often necessary. The flap is then replaced and the skin sutured, care being taken to pass the stitches entirely through the scalp in order to stop bleeding from the scalp wound after the clamp is loosened. No attention is paid to the resected zygomatic process unless it refuses to stay approximately in its right position. In that case it is held in place by a few cat-gut sutures. During this portion of the operation the patient is permitted to awaken and is placed in the vertical position. The dressings are applied and carefully bandaged. It is well to place a light gauze pad over each eye and to apply a loose bandage over this, because in this way the eye on the normal side will remain quiet and with its fellow will remain undisturbed. If the normal eye is left open the other eye will be compelled to move with every motion of the normal one, and consequently it will be likely to be disturbed unnecessarily.

This operation in the hands of all operators together has given a considerable mortality, probably exceeding twenty per cent., while in the hands of a few surgeons who have a carefully developed method the mortality has been exceedingly small.

EMPYEMA OF THE ANTRUM OF HIGHMORE.

For the relief of an empyema of the antrum of Highmore the most convenient and satisfactory point of approach is through the canine fossa. A longitudinal incision is made parallel with the alveolus of the upper jaw, two centimeters in length, at the point at which the mucous membrane extends from the jaw to the cheek. The periosteum is elevated for a distance of two centimeters and is held out of the way by means of retractors. Then an opening one and one-half centimeters in diameter is made by means of a gouge, the ordinary carpenter's chisel and mallet again being used. The cavity is then carefully curetted, first with a large and then with a small curette; then it is repeatedly sponged out with a dry gauze sponge, which will remove any granulations or remnants of polypi. Then the entire cavity is sponged with a piece of gauze slightly moistened with ninety-five per cent. carbolic acid, or, better still, the entire cavity is tamponed full of a strip of gauze moistened in this manner. This tamponing is repeated a number of times, so that the entire lining of the cavity of the antrum has been kept in contact with the strong carbolic acid for a period of about five minutes. Then it is tamponed several times with a strip of gauze saturated with strong chemical alcohol in order to wash away any superfluous carbolic acid. After this the cavity is tamponed with iodoform gauze saturated with tincture of benzoin. This may be left in place for a number of days, the antiseptic qualities of benzoin being sufficient to prevent the cavity from becoming foul. After this has been removed it is usually sufficient to insert a small self-retaining rubber cannula through which the antrum can be irrigated daily with some mild antiseptic fluid. If the infection of the antrum has not been of long standing it is not necessary to make so radical an operation, the simple opening, irrigation and drainage of the cavity often sufficing.

In old cases it is well to remove the separating bony wall into the nose for permanent drainage and for the purpose of obtaining an easily accessible opening through which the cavity can be cleansed.

Surgery of the Skull.

GENERAL CONSIDERATIONS.

The thorough consideration of the surgery of the skull would require much more space than can be given it in this work, and consequently I have decided to describe only those operations which might be classed as emergency operations, leaving the others to be described by special works upon this subject.

ABSCESS OF THE MASTOID CELLS.

Patients suffering from infection of the mastoid process usually give a preliminary history of some infectious disease affecting the tonsils. This is followed by an infection of the cavity of the middle ear. The abscess of the middle ear may have been drained spontaneously by a perforation of the drum or the latter may have been incised, but there is usually a history of recurrence of this infection or a continuous infection indicated by the presence of interrupted or continuous discharge from the ear. Following this pain appears behind the ear in the region of the mastoid process. Frequently this pain subsides when the discharge reappears, indicating that drainage has been established from the mastoid process through the middle ear. In other cases the pain steadily increases and is presently followed by the occurrence of œdema over the region of the mastoid process, which may extend downwards upon the neck along the course of the deep jugular vein. In rare instances there may be fluctuation in the region of the mastoid process, or even perforation of the abscess, but usually the resistance of the periosteum covering this process is sufficient to prevent these conditions from appearing.

Still later the patient may suffer from diffuse headaches extending over a more or less extensive portion of the head, usually radiating from the site of the infected process. Still later the patient may become comatose or nausea or vomiting may appear, and this may be followed sooner or later by coma and death. The explanation of the condition described is in the fact that the infection has extended from the cavity of the middle ear into the mastoid cells. It has then progressed outward to the periosteum, or through this, or it has extended inward underneath the dura and has caused a more or less diffuse meningitis, sometimes accompanied with a subdural abscess, or it may have extended into the brain—giving rise to a cerebral abscess. These patients are usually seen by the practitioner before the infection has advanced beyond the mastoid cells, and it is at this time that the greatest amount of benefit can come from surgical intervention. At this time the operation is safe, it can be performed by any surgeon with ordinary skill, and the patient is not likely to suffer secondarily as a result. It is quite different if the operation be postponed until there has been a considerable extension of the infection. In that case it is scarcely proper for any one who has not had extensive experience in brain surgery to operate upon these patients, and even with the greatest skill the proportion of recoveries is but slight. In cases operated at the proper time, that is, during the early part of the infection, the drainage which can easily be established will prevent the further infection of the deeper structures, and consequently will make a more extensive operation unnecessary.

Indications for Operation.—It would seem that the presence of pain, together with even a slight amount of œdema in the region of the mastoid process, the pain being increased upon pressure, and in any case in which there is a history of previous infection of the middle ear, would be a distinct indication for an operation.

Operation.—A sufficient amount of hair is shaved in the vicinity of the mastoid process to prevent annoyance in applying the dressings later on and to prevent the hair from interfering with the progress of the operation. A vertical incision is then made directly behind the ear, one and one-half inches in length, whose center is at a point one-fourth of an inch behind and exactly on a level with the upper margin of the external auditory meatus. This incision should extend down through all the tissues to the bone. The periosteum is carefully reflected and in this manner the mastoid process is exposed.

If the points which have just been mentioned are borne in mind, the operation can be performed with safety by any one, the opening into the mastoid cells being made by means of an ordinary carpenter's gouge about one-half inch in diameter.

The dangers of the operation are in opening the meninges above or in opening the sinus behind, but if the operator makes his initial opening in the mastoid process at a point on a level with the upper margin of the external auditory meatus and one-fourth of an inch behind the posterior margin, these dangers will be entirely avoided. After the mastoid cells have once been opened the opening can easily be enlarged by chiseling in every direction from this central point. The mastoid cells will be found to contain pus in various quantities from a few drops to one-half a drachm or more. This is carefully sponged away and the external opening is enlarged until it is as large in every direction as the greatest diameter of the underlying cavity, so that the cavity which is left will be conical in shape, with the base of the cone directed upward. Care should be taken not to injure the branch of the facial nerve extending along the edge of the external auditory meatus, but this can be easily done by simply bearing in mind the anatomical position of this nerve and working away from it with the chisel, instead of toward it. The cavity after being thoroughly cleansed, is loosely tamponed with gauze and a dressing is applied over it.

After Treatment.—The dressing is renewed at first every day, and later less frequently, the opening in the mastoid being permitted to heal from the bottom by granulation. In advanced cases, and in cases in which the infection has existed for a sufficient time to insure the involvement of surrounding tissues, a more extensive operation is indicated, but this should be performed only by those experienced in surgery upon the skull, because the dangers of causing permanent injury are much greater, and the necessity of the operation is not so urgent as in acute mastoiditis; consequently these cases can safely be postponed until the proper preparations can be made. The conditions are, therefore, quite opposite in acute mastoiditis, the operation is simple, safe and strongly indicated at once, and postponement is connected with great danger. In chronic cases the operation is complicated, difficult and dangerous, while postponement is relatively safe.

MASTOID OPERATION IN CHRONIC CASES.

It is difficult to describe this operation so that it can be performed safely by one who has neither accomplished it upon the cadaver nor has seen it done upon the living subject, and I believe, therefore, that this operation is not justifiable unless the surgeon has performed it upon the cadaver. The incision is the same as in the operation just described; the periosteum is then stripped away toward the external auditory meatus and a blunt periosteotome is passed down between the bony canal of the external auditory meatus and the skin lining this canal, so that the latter is loosened down to the tympanum. The mastoid antrum is then opened as described in the former operation, and the lower layer of the posterior wall of the bony portion of the external auditory canal is removed with a chisel, so that the external auditory meatus and the cavity in the mastoid form a continuous conical opening. The cavity of the middle ear is then opened and the hammer and the anvil are removed by means of forceps. Great care must, of course, be taken to protect the branch of the facial nerve which passes through the bony wall of the external auditory meatus. The skin lining the external auditory meatus is then split longitudinally and spread out over the surface of the newly-formed cavity for the purpose of lining this, thus increasing the size of the external auditory meatus greatly. It is held in place by means of a tampon of iodoform gauze.

LIGATION OF THE MIDDLE MENINGEAL ARTERY.

The next most commonly indicated operation upon the skull is for the relief of pressure upon the brain due to hæmorrhage resulting from an injury to some portion of the middle meningeal artery. A patient receives a slight injury from which he recovers in a very short time, usually within a few minutes. He is able to go to his home, but later on becomes unconscious, his pulse becomes slow, and unless relief is secured within a very short time the patient succumbs to the effects of intra-cranial pressure. The history in these cases is usually so clear and the symptoms so pronounced that there is little difficulty in making the proper diagnosis.

TREATMENT.—The treatment in these cases must be applied at once, because if this is neglected the patient's condition will soon become hopeless.

PREPARATORY TREATMENT.—The danger of infection of the meninges is greatly reduced by thoroughly shaving the entire scalp before the commencement of the operation. If only a small portion of the surface is shaved it is likely that during some part of the operation some one will carry infectious material from the remaining portion of the scalp to the wound and cause an infection, which in these cases is always serious. If the entire scalp has been carefully shaved the further disinfection is no more difficult than disinfection of the skin in any other portion of the body.

If the point of injury can be distinctly located in the course of one of the principal branches of the middle meningeal artery, the point of operation can be determined in this manner. If this cannot be done it will become necessary to expose first one and then the other of the principal branches of this vessel, provided the first attempt fails, or it may be better to expose both branches at once by making an osteoplastic resection of a portion of the skull covering both the anterior and the posterior branches of the middle meningeal artery. The following guide will suffice to locate these branches.

The anterior branch crosses a point one and one-fourth inches backward and upward from the external angular process of the frontal bone. The posterior branch crosses a point at which this line crosses a line drawn vertically from the anterior edge of the mastoid process. An opening can be made at these points by means of a trephine one-half inch in diameter; the instrument should, however, be conical in shape so that as soon as the inner table of the skull has been perforated by it the instrument is stopped automatically from penetrating deeper and causing an injury to the dura. It is usually best to make an oval skin flap covering the area traversed by both the posterior and the anterior branch of the

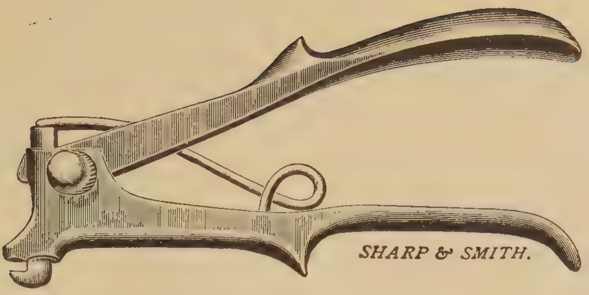


Fig. I.

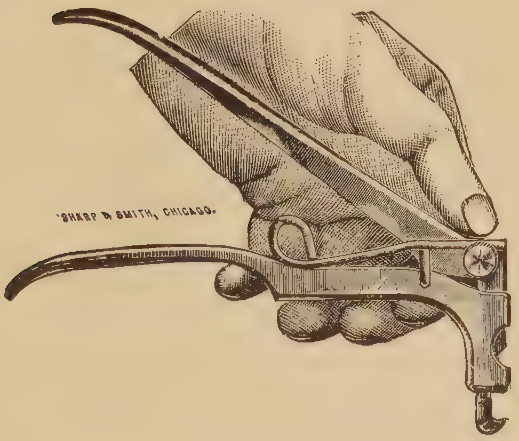

SHARP & SMITH, CHICAGO.

Fig. II.

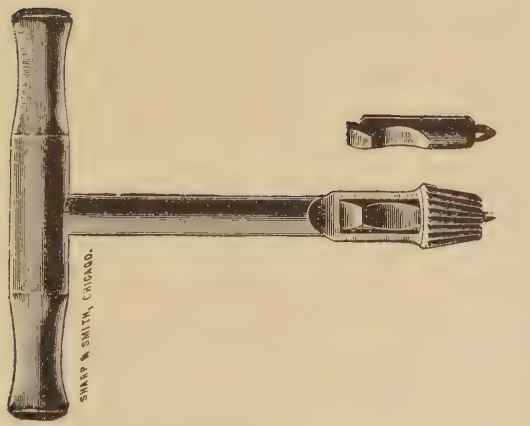


Fig. III.

PLATE LXI.

De Vilbiss Forceps.

Fig. I represents the forceps when partly closed. Fig. II indicates the proper manner of holding the forceps in the left hand while introducing the punch (c) through the trephine opening and sliding it through the groove in the skull, which has already been made. The right hand being employed entirely for the purpose of closing the handles and thus forcing the punch through the bone within its grasp. Fig. III represents the proper form of trephine to be used. Its conical shape prevents injury to the dura, because it locks the trephine the moment the bone is cut through, because this at once causes all of the lateral teeth to become imbedded in the hole which has been cut.

middle meningeal artery, so that if the injury is not found in the anterior branch, which is most commonly the seat of trouble, an elliptical-shaped flap of the parietal bone may be cut loose by means of DeVilbiss forceps. In this way much time can be saved and the surface can be so thoroughly exposed that no error is possible, as shown in Plate LX.

In making the resection of the skull the size and form of the flap can be regulated by directing the instrument. A flap sufficiently large to cover the space occupied by the posterior and anterior branches of the middle meningeal artery can be cut with the DeVilbiss forceps in a very short time, usually less than ten minutes being required for this purpose. It is, however, necessary to bear in mind the technique required in the use of these forceps. The cutting portion of the forceps should be introduced through the originally provided opening, and then it should be slid along the cut which has already been made until the end is engaged under the portion of the skull to be severed. Unless this precaution is taken the work will progress very slowly. The small bridge at the base of the bone-flap is weakened by the application of a few strokes of the chisel and then it is fractured by inserting a strong chisel opposite this point and elevating the flap. The bleeding vessel is now exposed and ligated by passing about it a fine cat-gut ligature threaded in a needle, the clot is sponged away, the bone flap is replaced, and the overlying skin is sutured. If there is still some oozing after the injured portion of the meningeal artery has been ligated it is wise to place a small capillary drain underneath the flap to prevent re-accumulation of blood.

DEPRESSED FRACTURES OF THE SKULL.

In the treatment of acute injuries of the skull, it is important to bear in mind that depressed fractures, although frequently not accompanied with serious symptoms at the time of the injury, are likely to result in exceedingly serious late conditions, unless the difficulty is relieved quickly after the injury. The irritation resulting from a depressed fracture frequently gives rise to epilepsy at some time after the occurrence of the injury. In order to prevent this, it is important in every case in which there is a depressed fracture to elevate this at once, which can be accomplished by exposing the seat of the fracture by an incision through the scalp, the latter having been shaved as indicated in connection with the previous operation. If the fracture is comminuted a small portion can usually be removed by the introduction of the sharp edge of a chisel, and with the use of this instrument, together with the use of sequestrum forceps, it is usually possible to adjust the portions of the depressed fracture very accurately. If this cannot be done it is safer to sacrifice some portions of the skull than to leave any depresesd part to irritate the meninges.

If an injury is found in the dura this should be sutured with cat-gut. After the skull has been carefully adjusted the scalp is sutured over this with or without capillary drainage, according to the amount of oozing that remains. Care should be taken to sacrifice as little as possible of the skull, and in simple fractures fragments may be replaced with safety, although they may be entirely separated both from the dura and the periosteum. In compound fractures the same plan of treatment must be pursued, with the addition of very careful disinfection, the removal of all fragments of the skull which may have become infected in the least and the use of drainage in all of these cases.

In all chiseling operations upon the skull and elevations of fragments, the ordinary carpenter's chisel and a mallet, such as the one used by wood carvers, are of the greatest convenience. The bone chisels which can be obtained in instrument stores are practically useless for this purpose, because they are either clumsy or difficult to handle, while the carpenter's chisel can be used with ease by any one who has the least manual capacity. A convenient amount of bone can be cut away in a few moments with this instrument and the form of the incision in the bone can be easily controlled. The chisels are so sharp that their use does not give rise to any severe concussion. This is especially true if the edge of the chisel is held nearly parallel with the surface of the bone. A number of chisels should be at hand so that if there is any defect in one it can be laid aside and another substituted.

CLOSURE OF BONY DEFECTS IN THE SKULL.

In case a considerable portion of the skull has been entirely removed, it may become desirable to close this defect in order to protect the patient against an accidental injury of the unprotected portion of the brain. This becomes necessary only in cases in which the defect is very large, or in which it gives rise to some form of annoyance to the patient. The latter may feel a sense of insecurity or he may be annoyed by extreme heat or cold, or there may be a sensation of pain, or the constant pulsation of the area may give rise to a feeling of nervousness, or the irritation may give rise to epilepsy. In either case the defect may be closed by the insertion of a foreign substance between the scalp and the dura, such as a thin plate of celluloid, which can be boiled and cut the exact shape of the defect with a sufficient margin to hold the plate when inserted underneath the rim of the defect in the skull. If such a plate is implanted aseptically it will remain for an indefinite period of time without giving rise to any annoyance. I have used such plates in a number of cases with perfect satisfaction. It must be remembered, however, that in cases of epilepsy the number of cures from the use of such a plate is relatively very small.

An autoplastic bony closure may be accomplished by cutting an oval flap of the scalp directly along the side of the defect with a pedicle sufficient to supply circulation to the flap; then cutting a second flap of the same shape directly covering the defect and having its pedicle in the opposite direction from the one first made. The second flap is dissected loose, leaving the dura in place.. The latter is then loosened from its attachment to the rim of the opening and with a thin, broad chisel a thin layer of the skull underlying the first flap is chiseled loose and left in contact with the flap. The latter is then transplanted over the defect in the skull and sutured in place, and the second flap is then sutured into the space from which the first flap has been removed. In this manner all portions of the scalp will remain covered with hair and the bone carried with the first flap will effectually close the defect in the skull.

Usually this operation has been performed by removing the scalp from the surface of the defect and transplanting a flap from a neighboring portion of the skull, and then covering the defect with skin grafts, but the method which has just been described is very much more satisfactory because it does not leave a portion of the scalp without its hairy covering.

I wish once more to refer to the matter of disinfection of the scalp because this is of the very greatest importance even though there may be no fracture of the skull. The scalp is likely to contain the streptococci of erysipelas, and the infection may extend through the skull by way of the veins—giving rise to a septic meningitis. In my experience this has happened in a number of cases in which the injury was due to a blow with a blunt object, such as a brick or a piece of iron or anything hard or heavy. The disinfection in these cases should be just as thorough as though an operation were contemplated; and it is well afterward to apply a moist, antiseptic dressing of some kind and cover with some impermeable material, such as gutta percha, in order to complete the disinfection. The sooner this is accomplished after the time of the injury the better. It is unfortunate if it be postponed until the tissues have become œdematous as a result of infection.

TUMORS OF THE SKULL.

The removal of tumors of the skull has been followed, in my experience, with so little success that I am not prepared to advise this form of treatment in any of these cases. My experience in operations for the relief of intracranial tumors has been quite as unsatisfactory as that of tumors of the skull proper, and consequently I am not prepared to discuss this phase of surgery.

Surgery of the Genito-Urinary Organs.

VARICOCELE.

History.—This condition is found mostly in young adults, in boys above the age of sixteen.

There are three distinct classes under which all patients suffering from this condition may be distributed from a clinical standpoint. In the first class there are no symptoms; the patient discovers the deformity by accident or the condition is recognized by his physician incidentally. In the second class the patient has suffered severely from a dragging pain in the left side of the scrotum, extending into the groin and frequently into the back. This pain is increased when the patient is compelled to stand at his work or to lift heavy weights. It is also much more severe when he is tired, especially during the warm weather. This is a marked feature of varicocele, that the number of cases regularly increases in our hospital service with the approach of warm weather and decreases with the approach of winter. In the third class the patient is neurasthenic and has attributed many forms of mental and physical suffering to the presence of the varicocele. He may suffer physically in the same manner as the patient in the second class, but the prominent symptoms are those of neurasthenia.

Examination.—There is a marked difference upon palpation in the right and left half of the scrotum. On the right side can be distinguished a hard, cord-like structure—the vas deferens—extending the entire distance of the scrotum, and the testicle located at its lower end. On the left side these structures are almost concealed by a large accumulation of elastic, worm-like structures coiled upon themselves, giving rise to the sensation which has been compared to the manipulation of a number of angleworms. This is due to the great dilatation of the spermatic veins, which are in a varicose condition.

If the patient is placed in the recumbent position the veins become empty and can no longer be felt unless the affection has existed for a long period of time, in which case the walls of the veins themselves will have become thickened in the natural tendency of compensation, and then the change in the fullness of the vessels will not so completely alter the impression upon palpation.

Very rarely the condition is present upon both sides, and still more rarely upon the right side alone, because the anatomical difference of the two sides favors the formation of varicocele upon the left side.

Differential Diagnosis.—The malady is so characteristic that it is not likely that it can ever be confounded with any other.

Indications for Operation.—In the first class described the operation is plainly not indicated, because in itself the condition is harmless so long as it gives rise to neither pain nor discomfort. It neither causes any other pathological condition nor does it predispose to any; hence there can be no good reason for surgical procedure. In these cases it may be proper to advise the patient to wear a well-fitting suspensory bandage, which will tend to prevent the further dilatation of the veins.

In the second class surgical treatment is strongly indicated, because, if properly executed, it will result in permanent relief in almost every case. It can be performed with safety to the patient, and it will disable him from work only for a very short period of time.

In the third class it is necessary to determine whether there is any possibility of causal relation between the existence of the varicocele and the neurasthenia. If such a relation can be established the operation is plainly indicated. If there is as plainly no relation between the two conditions, then the operation is not indicated unless there seems to be reason to suppose that the presence of the deformity causes undue anxiety in the mind of the patient, which in turn causes or increases his neurasthenia. In such case the removal of the deformity might remove one cause of the neurasthenia.

If there is a doubt in these cases it seems but fair that the patient be given the benefit thereof, and that surgical relief of the pathological condition be employed.

Operation.—An incision three to four centimeters in length is made directly over the spermatic cord downward from a point just below the external abdominal ring. The blood vessels which appear in the incision are either caught at once between two pairs of hæmostatic forceps and then cut, or the incision is made directly down to the tissues of the spermatic cord and the bleeding points caught with hæmostatic forceps.

It is important that throughout this operation all bleeding be carefully controlled, in order to prevent infiltration of the tissues with blood or the formation of a hæmatoma, for both of these states are exceedingly annoying, not so much on account of their importance as because of the anxiety they give to the patient.

The cord is then brought up into the wound and the vas deferens, with a few of the accompanying small arteries and veins, isolated. This leaves the great mass of varicose veins in a separate bunch. After carefully carrying this separation from the external abdominal ring to a point half an inch from the testicle, the mass of veins is transfixed above and below with a double cat-gut ligature and tied in halves. The intervening portion is then cut away, caution being taken to leave a sufficient amount of tissue beyond the ligatures to prevent slipping. The two stumps are then united with cat-gut sutures to prevent the dragging down of the testicle, with its subsequent discomfort.

The deep fascia is then sutured with fine cat-gut, and later the skin. It seems wise to suture the fascia separately in order to prevent the infection of the deep tissues from the skin. An ordinary gauze dressing is applied to the wound and held in place with a suspensory bandage. The wound usually heals within a week, and the patient is able to perform ordinary work in two weeks. This is a very satisfactory operation as a rule, because it is thoroughly appreciated by the patient.

HYDROCELE.

This condition may affect either the tunica vaginalis of the testicle or of the spermatic cord, or both.

History.—The change is usually attributed to an acute trauma or there may have existed an orchitis due to a specific urethritis. The physician is usually not consulted until the tumor has attained so great a size that its weight gives rise to discomfort and it may annoy the patient on account of the deformity, or it may even interfere with locomotion. It is usually, but not always, unilateral.

Differential Diagnosis.—Aside from the rare occurrence of sarcoma so soft in structure as to simulate fluctuation upon palpation, the only condition with which hydrocele can be confounded is scrotal hernia. This is true especially in children in whom the contents of a hernia frequently give the same feeling on palpation as the liquid contained in a hydrocele. This is especially true in hydrocele of the cord which is located in the lower end of the inguinal canal and which can frequently be reduced through the inguinal canal into the peritoneal cavity. There is, however, this difference. The hydrocele will always reduce as a solid mass, only to reappear in a few moments without regard to the form of truss that may be applied, while the hernia will give the sensation of being composed of loose substance, and it will remain reduced if properly supported by a truss.

In hydrocele of the tunica vaginalis the light test is the most reliable. A small tube is applied to the side of the scrotum, then a light is placed upon the opposite side. If the light is seen through the tube it is an indication that the mass is composed of a sac containing transparent fluid. However, it sometimes happens that the hydrocele is so thick-walled in old patients that no light will shine through. Occasionally the fluid may not be transparent, being discolored by the presence of blood pigments, and then the light test may be misleading. A very simple test consists in grasping the scrotum, directly above the mass, between the finger and thumb. If the tissues of the cord can be plainly distinguished the case is one of hydrocele; if not, it is a case of hernia.

Abscesses can be distinguished on account of the evidences of inflammation; œdema of the scrotum, because of œdema elsewhere in the body. Tumors of the testicle are usually hard, and do not fluctuate.

Occasionally in old patients in whom the hydrocele has existed for a long time, especially if it has been frequently tapped, the walls of the cyst undergo calcareous degeneration, giving the impression of a hard tumor. This condition has repeatedly been mistaken for sarcoma or enchondroma, a mistake which is quite unfortunate, because it is usually not discovered until the organ has been removed.

Treatment.—In children simple tapping will suffice to bring about a permanent cure. This may be repeated a few times if necessary, and if not permanently successful it should be followed by the injection into the sac, after the latter has been very carefully emptied, of a few drops of ninety-five per cent. carbolic acid. The cannula of the trocar should be closed and left in place while the carbolic acid is distributed over the entire surface by carefully massaging the scrotum. After a few minutes the cannula should be opened, and whatever fluid may have again accumulated, together with the carbolic acid, should be again drawn off.

During the entire manipulation the external abdominal ring should be compressed, in order to prevent the introduction into the peritoneal cavity of any portion of the carbolic acid, in case the upper end of the tunica vaginalis has not yet become entirely closed.

In hydrocele of the cord in children tapping alone almost always suffices. If this is not the case, it is well to make a longitudinal incision, opening the hydrocele and tamponing the cavity with iodoform gauze. After a few days this may be removed and the wound will heal completely in a short time. It does not matter that the inguinal canal is thus left wide open after the hydrocele of the cord which closed it has been emptied and can consequently no longer act as a plug. During the short period that the child will be compelled to remain in the recumbent position the canal will contract sufficiently to prevent the protrusion of a hernia.

Treatment in Adults.—If the patient can conveniently abandon his work for one to two weeks, it is usually best to advise the operation for radical cure, which will be described presently. If he cannot leave his work and desires only temporary relief, tapping will accomplish this. If he cannot remain away from his work, but still desires to obtain some hope of a permanent cure, without a certainty, it may be well to make use of the ninety-five per cent. carbolic acid, which has just been mentioned, with a change in the quantity to be employed. After aspirating the fluid, from one to two drachms of ninety-five per cent. carbolic acid is injected and forced to come in contact with every portion of the lining of the sac by the use of massage. The acid should be left in contact with the surface for at least five minutes, then it should be forced out through the cannula, which has in the meantime been kept closed. The patient should then be put to bed for a few hours, after which he may resume his occupation. In my own practice I have frequently applied this treatment on Saturday evening, and the patient has always been able to resume his work with perfect comfort on Monday morning.

In about one-half of all the cases this method will result in a permanent cure, and it is worth while to explain to each patient who comes for treatment the first time that in about one-half the cases this simple method will accomplish everything the patient may desire. The method has the further advantage of being painless.

Operation.—An incision, one and one-half inches in length, is made over the anterior surface of the side of the scrotum involved, directly down through the tunica vaginalis, which will permit the fluid to escape. The inner surface of the sac and the surface of the testicle are now carefully inspected in order to detect any tubercles which might account for the accumulation of fluid. If these are present they are carefully removed, preferably with the knife of an electro-cautery. If none are present the tunica vaginalis is inverted over the testicle and held in place by a few stitches of cat-gut; then the testicle, together with its inverted tunica vaginalis, is replaced in the scrotum. Great care is exercised to secure absolutely perfect hæmostasis in order to prevent any accumulation of blood in the scrotum after the operation. The deep fascia is first sutured with cat-gut and then the skin is united. An ordinary dressing is applied and held in place by a suspensory bandage.

Prognosis.—The wound heals in a few days, and in a week the patient is able to follow his usual labor. The operation is so simple, safe and satisfactory in its results that it seems foolish for a patient to carry a hydrocele about for years and go through the annoyance of repeated tappings when he might in a few days obtain permanent and perfect relief.

CYSTOTOMY.

During the past few years it has become an almost universal practice to open the bladder through the suprapubic incision for the removal of stones, for the removal of foreign growths, and for the permanent drainage of the bladder for any cause. The operation in itself is relatively simple.

Preparatory Treatment.—Before undertaking any operation upon the bladder it is desirable that the urine should be as nearly aseptic as possible. Measures should be taken to make the urine as nearly normal as the conditions of the patient will permit. The condition for which the operation is performed usually predisposes to an abnormal state of the urine, and frequently not only the bladder, but also the kidneys are diseased. If the urine contains septic material this condition can be changed by dilution, the patient being given large quantities of distilled water, or, if this is not agreeable, one of the various mineral waters may be given in large quantities. This in itself will reduce the septic nature of the urine to a great extent. If the urethra is permeable to the passage of a catheter, irrigation of the bladder with a mild, non-irritating antiseptic solution, such as a solution of boric acid, a 1 :1000 solution of permanganate of potash, a 1 :2000 solution of nitrate of silver, a saturated solution of acetate of aluminum, or a solution of any one of a number of recently produced silver salts, may be used to advantage. Care should be taken not to irritate the bladder with any of these solutions. If it is found that one irritates more than the other it should be avoided. The bladder should be filled moderately full and then the fluid should be permitted to escape again, or the bladder may be irrigated with a constant stream through a double catheter, one tube serving the purpose of introducing the fluid, the other the purpose of emptying the bladder. A repeated examination of the urine will determine whether this treatment reduces the amount of septic material regularly found.

There are a number of antiseptics which can be given internally for the purpose of disinfecting the urine. Of these five grain doses of boric acid given with half a pint of distilled water, or mineral water, every three hours; the same dose of salol, or of urotropine, or one-grain doses of methylene-blue given in the same manner, are probably the most useful. There is, however, this fact to remember, that urine usually is most septic if the bladder is not at any time completely evacuated, and consequently in these cases but a slight amount of benefit can be expected unless this residual urine is removed once or twice, or oftener, each day and the bladder carefully irrigated.

Just before attempting the operation the bladder should again be carefully and repeatedly irrigated in order that an accumulation of septic material may be thoroughly washed away and any remnants that cannot be washed away may be thoroughly diluted. In many cases the bladder contains weakened points and consequently great care should be taken in this final irrigation, which is usually performed after the patient has been anæsthetized, not to fill the bladder with too much force for fear of causing a rupture at some frail point. After this irrigation has been completed the bladder should be filled moderately either with water or with air. The former can be introduced through a catheter by means of an ordinary bulb syringe, more than eight ounces being introduced. The quantity can be measured by the size of the bulb which is used. In case air is used, it is best to leave the catheter in place after the bladder has been irrigated and to attach it by means of a glass tube to a rubber bulb. The incision is then made through all the tissues down to fat in the space of Retzius. Then the bladder is pumped full of air and it can be observed as it expands in the depths of the wound.

The field of operation has, of course, been carefully shaven and prepared; then a longitudinal incision is made in the median line directly upwards from the os pubis, a distance of five centimeters. The muscles are separated and the fat above the pubis and in front of the bladder is exposed. This contains a number of veins of considerable size which usually extend transversely or obliquely across the incision. These should be grasped with hæmostatic forceps on each side, cut and ligated at once. The incision is carried through the fat down to the wall of the bladder. In making this dissection great care should be taken not to extend the incision too high for fear of entering the peritoneal cavity. This is not likely to occur, however, if the bladder is filled with water or air unless the bladder is pendulous and displaced backwards. In this case the peritoneum may approach the os pubis and may have to be shoved upwards and held out of reach of the operation by means of retractors. A suture is then applied to the wall of the bladder in the upper angle of the wound for the purpose of securing it against separation from the anterior abdominal wall. Two other stitches are applied in the bladder wall with curved needles one centimeter to each side of the median line. Forceps should be applied to each one of these stitches, and the bladder wall should be drawn forward gently. A longitudinal incision is then made, from one to three centimeters in length, according to the object of the cystotomy, and the edges of the wound grasped with fine-toothed forceps and held open while the interior of the bladder is being exposed. As soon as this incision is made the fluid (or air) contained in the bladder will escape and the bladder walls will begin to contract. If a stone is present its size can be determined and the incision in the bladder wall can be increased if necessary. The position of the stone is determined with the finger, and it is grasped by means of stone forceps in its narrowest diameter and withdrawn from the wound in the bladder with the gentlest possible motion. The bladder should then again be examined for the presence of further stones, and this should be repeated until all the stones have been removed. If a tumor is present an assistant should introduce two or three fingers into the rectum and should force the tumor forward toward the wound so as to facilitate its examination and removal.

The method of removal of a tumor will depend largely upon its size and location, and must be determined upon general principles in each case.

If the operation has been performed for the purpose of securing permanent drainage, the incision should be made as near the os pubis as possible, and should be only just large enough for the purpose of permitting careful digital exploration. Several purse-string sutures should then be applied in order to prevent leakage, and a retention catheter introduced. The wound should be tamponed around this retention catheter and the stitches in the bladder wall should be passed through the edge of the wound and tied just sufficiently tight to hold to the anterior wall in close apposition with the abdominal wall. A few silkworm gut sutures are then applied, so as to grasp the wound on each side, and to take a small bite in the anterior wall of the bladder above the point of incision and two small bites, one on each side of the incision in this portion of the bladder. These sutures are left untied until the first dressing, which occurs a few days after the operation, when the gauze tampon and the three first stitches may be removed and the silkworm sutures may be tied, leaving only a space open through which the drainage tube passes. If the bladder has been in a septic condition, it is often best to pass two ordinary rubber drainage tubes one-half a centimeter in diameter, perforated with several small openings in the end. It is then possible to irrigate the bladder by permitting the fluid to flow in through one of these tubes and out of the other; and in case one or the other becomes occluded with mucus or blood the free one will suffice to drain the bladder.

After-Treatment.—The most important point in the after-treatment of these cases consists in giving the patient large quantities of pure water to drink. If the patient is at all shocked by the operation it is wise to give him a saline transfusion at once or to give him an enema of half a pint of normal salt solution every hour. The bladder is irrigated with a saturated solution of boric acid from two to six times a day, according to the character of the urine. If two rubber tubes are employed, sufficiently long for the ends to project into an antiseptic solution in a bottle tied to the side of the bed, the patient will usually remain perfectly dry. It is a good plan to insert a glass tube into the end of the rubber tube, so that its weight will keep it from becoming dislodged from the bottle. If the presence of the rubber tubes gives rise to pain their position should be changed occasionally. The bladder contracts and then these tubes cause irritation by pressing upon the posterior wall of the organ. If the operation is performed for the removal of a stone from a healthy bladder containing nearly normal acid urine the wound in the bladder may be closed by a double row of cat-gut sutures, which are not permitted to penetrate the mucous membrane, however. The space between the bladder and the abdominal wall should always be drained thoroughly in these cases for fear of extravasation of urine. A soft rubber retention catheter is placed into the bladder through the urethra in such instances and carefully fastened in place, so as to keep the bladder thoroughly drained. If there is any doubt about the aseptic condition of the bladder it does not seem wise to close the bladder wall completely. In case the operation is performed for the purpose of securing permanent drainage, the smaller the opening in the bladder the better will the operation serve its purpose. In these cases it is well to make the opening in the bladder as near the urethral opening as possible. If a permanent drainage is employed, the bladder should be irrigated at least once a day with some mild antiseptic solution, and it is advantageous to change the character of this solution repeatedly, because an occasional change will increase the usefulness of any of the various antiseptic solutions which have been mentioned in connection with irrigation of the bladder.

URETHROTOMY.

In the presence of urethral strictures which cannot comfortably be kept open by means of bougies passed regularly by the physician, or in the presence of this condition accompanied with a constant or interrupted discharge, or in the presence of pain, or other abnormal conditions which can be attributed to a stricture, the latter should be thoroughly divided. This is true even in cases in which annoying nervous symptoms referable to the presence of strictures exist in cases in which it is possible to pass a sound of the normal size.

History.—These patients usually give the history of one or more attacks of gonorrhœal urethritis, followed in time by an obstruction to the flow of urine, which may be only slight or it may be almost complete. During the entire time there may have been a certain amount of urethral discharge, possibly only a drop in the morning. This condition may be associated with an irritable bladder, which refuses to retain the urine for the normal period of time. There may be a sensation of scalding during the evacuation of the urine.

Examination.—The urethra should be thoroughly irrigated with a saturated solution of boric acid, or a solution of 1:1000 of permanganate of potash before an instrumental examination is made. If time permits, it is wise to give these patients from five to ten grain doses of boric acid or salol, or both, from three to six times a day, with half a pint or more of pure water, preferably hot, for several days. This will have a tendency to disinfect the bladder and the urethra. In many cases it is wise to give the patient five-grain doses of quinine with a pint of hot water three times a day for one or two days before attempting an instrumental examination of the urethra. Many patients who have repeatedly suffered from severe sepsis characterized by a chill known as a urethral chill, followed by severe fever after an instrumental examination, have remained entirely free from these symptoms after future examinations of the same character if the examination was preceded by the use of quinine.

The same conditions are true regarding the gradual dilatation of the urethra by means of hard rubber bougies or steel sounds. After the necessary preliminary preparation has been made a moderate sized urethral sound lubricated with some sterile oily substance is introduced with great care to the prostatic urethra, but not through it. If this sound encounters any obstruction a smaller one is used and the size is reduced successively until a very small sound is tried. The smaller the sound, however, the greater must be the care in its introduction, and whether the sound be small or large it must always be introduced absolutely without the use of force, for fear of doing injury to the delicate structure of the canal. If the original sound passes to the prostatic urethra then successive sounds are introduced until the largest one has been secured that can be passed without force.

If any one of the sounds used meets an obstruction it is withdrawn and the depth of the obstruction is carefully noted; also the size of the largest sound which will just pass this obstruction.

The urethra is next examined by means of a bulbed sound, the bulb having approximately the shape of an olive. These sounds are introduced in successive sizes until the size is reached which will just pass the constriction. It is then passed on and may possibly encounter further constrictions, which it may or may not pass. If a constriction smaller in size is encountered, smaller bulb sounds are used to determine the size of such obstruction. The locations of all constrictions are carefully noted as to their depth and size. After all these facts have been determined an Otis urethrotome is introduced into the urethra and the indicator turned to the point registering the size of the smallest stricture, the point of the urethrotome being inserted one-half inch beyond the location of this stricture as determined by the measurements. The concealed knife is directed either downwards or upwards, so that the cut will be precisely in the median line. It is then withdrawn a distance of an inch or a little more, and then again forced into its position of concealment. The urethrotome is then withdrawn and the urethra is further measured for other strictures; and in case these are found they are treated in the manner just described.

After repeated examinations determine every portion of the urethra to be normal in size, as measured by the bulbed sounds, and after this method of examination has indicated the urethra to be uniform in size, a large urethral sound, No. 30 to No. 40 French, according to the size of the patient, is introduced. If the bleeding is profuse a large catheter is passed and the cut surface is held against this catheter by means of rubber adhesive straps applied circularly over a padding of cotton at least one-half inch in thickness. In this manner hæmorrhage can easily be controlled. The catheter is left in place for twenty-four to forty-eight hours, and the bladder is irrigated through it with one of the various antiseptic solutions before mentioned, from one to six times each day, according to the character of the urine. The same after-treatment which has been described for cystotomy, so far as the administration of large quantities of water and internal antiseptics are concerned, should be followed. After the fifth day steel urethral sounds, or hard rubber bougies are introduced, at first once every three or four days, then every second day, then every day, and when the urethra has been permanently dilated so that it will comfortably take the largest desirable sound the frequency of treatment may be reduced again; at first they are to be used every second, then every third, then every fourth day, etc., until presently they are introduced but once a month. This should be continued for many months until the surgeon has evidence that no further contraction will take place. It is to be remembered that a urethra which has once been strictured can be kept open with much less difficulty and with much greater comfort if a series is passed once a month than if the stricture is permitted to reform and has to be gradually dilated. In case it is impossible at the primary examination to pass a sound of any size through the stricture the patient should be placed in bed and the further treatment which has been mentioned should be prolonged. Patients should also be given hot baths, and after this treatment has been continued for some time it will be found that the stricture is not so tight as it was at the beginning of this attention. It will then usually be possible to introduce a filiform bougie. This should be attached to the end of a conical sound, and with this the stricture should be slightly distended. After this has been accomplished the conical sound is replaced with the urethrotome and the stricture is cut as described before. Entire urethrotomy is, however, not safe in strictures located beyond the distal half of the membranous portion of the urethra, because the use of this method is likely to be followed by severe extravasation of blood and sometimes by extravasation of urine; the latter may result in the sloughing of a great amount of tissue.

EXTERNAL URETHROTOMY.

In very tight strictures of the membranous portion of the urethra it is probably always best to perform an external instead of the internal urethrotomy. If the stricture is tight, however, the internal urethrotomy should always precede the external, because with a filiform bougie attached to the conical sound, and later to the urethrotome, as has just been described, it is practically always possible to split the stricture smoothly and with the infliction of as little unnecessary traumatism as is possible to the urethra; moreover, after the internal urethrotomy has been performed a grooved steel sound can be introduced into the urethra and then the external urethrotomy can be done without great difficulty.

It is quite the opposite if an external urethrotomy is undertaken in case of a tight stricture instead of first performing an internal urethrotomy, because the exceedingly small opening in the strictured portion of the urethra can often be found only with the greatest amount of difficulty, if at all, and in the search for this opening a great amount of tissue is frequently destroyed. Had the internal urethrotomy been performed in the same case before the external urethrotomy is attempted, all of this traumatism would be avoided. In case, however, it is impossible to introduce a filiform bougie through the stricture, and consequently impossible to perform an internal urethrotomy, an attempt may be made at finding the remaining opening through an external incision. Occasionally the surgeon may be more fortunate in his search than he could reasonably expect, and in this way he may discover the remnant of the original canal. If this fails, however, after a reasonable attempt, it is best to perform a suprapubic cystotomy and to introduce into the urethra from the side of the bladder a sound, and to carry this down into the wound of the urethra to the point of the stricture, and then to cut down externally upon the point of this sound. With this guide it will then be possible to slit open the stricture. Preferably a fine probe is used, which is introduced from the upper portion of the stricture downward, the latter being at the end of the sound which has just been introduced from the bladder.

After-Treatment.—The wound is then open and dressed with ordinary antiseptic dressings. The remnant of the mucous lining of the urethra will begin to proliferate and form a covering of mucous membrane over the adjoining portion of the wound. Presently it will show a tendency to close in upon itself and to reproduce the original canal. In the meantime care should be taken not to permit the distal end of the urethra becoming again contracted. This can be prevented by the introduction of steel sounds once every two or three days. After the urethra shows a tendency to close a catheter should be introduced into the bladder through the entire length of the urethra and the wound should be permitted to heal around this catheter. The same precautions for the dilution of urine which have been described after suprapubic cystotomy should be employed in these cases. Occasionally an external urethrotomy is indicated by the presence in the urethra of a fistula, showing the existence of the stricture to the distal side of the fistula. The operation in such case is the same as that which has just been described.

RUPTURE OF THE URETHRA.

The most urgent condition necessitating external urethrotomy is the presence of a severe traumatism of the urethra. This is usually caused by falling astride of some hard substance, such as a beam or a board in buildings which are being constructed, or falling astride of a wagon wheel by teamsters, or falling upon the pummel of the saddle by horsemen, or any other similar condition. The patient suffers severe pain in the region of the perineum, there is usually a flow of a variable amount of blood from the urethra, there is an obstruction to the flow of urine, and upon introducing a catheter into the urethra it brings blood, but no urine. If the injury is recent these may be all the conditions which can be determined. If it has existed for a longer time there is present severe ecchymosis, there may be marked œdema, and there frequently is an area of necrosis, which varies with the severity of the injury and the length of time that has elapsed since its occurrence.

If the catheter which has been introduced passes the obstruction and enters the bladder, this will be indicated by the flow of urine. In such event, it is wise to irrigate the bladder with some antiseptic substance and to leave the catheter in place, for fear of not being able to reintroduce it in case it were removed and for the purpose of preventing extravasation of urine by the perfect drainage of the bladder, and also for the purpose of acting as a splint in directing the process of healing in the ruptured urethra. If the surgeon is not fortunate enough to be able to introduce the catheter into the bladder without the use of force, he should abandon the attempt without having increased the existing traumatism, the only rational means then of treating these cases being with an external incision.

OPERATION.—The patient is placed in the lithotomy position, the skin is prepared for operation, a longitudinal wound is made upon the end of the urethral sound which has been introduced to the point of obstruction. This sound will indicate the location of the distal end of the urethra. If it is difficult to locate the proximal end of the urethra this can usually be effected by making gradual pressure upon the bladder, thus forcing out some of the urine, which will indicate the proximal end of the canal. The incision is then prolonged until it passes the proximal end of the urethra for a distance of about an inch. The two extremities of the urethra are then united by means of fine cat-gut sutures for about two-thirds of their circumference, the most superficial third being left for drainage. A catheter is then introduced through the entire urethra into the bladder, and the remaining portion of the wound is permitted to heal by granulation.

It has been my personal experience that a complete union of the urethra in these cases can be accomplished much more rapidly and perfectly if the entire circumference of the urethra is not sutured at once at the time of the first operation.

AFTER-TREATMENT.—The after-treatment in these cases is the same as in the previous ones. The retention catheter is left in place until the wound in the urethra has apparently completely healed. If the patient does not come under the surgeon's care until a considerable portion of the urethra has become necrotic, it may become necessary to excise this and to bring together portions of the urethra a considerable distance from each other. This, however, can be done with safety and with comfort to the patient.

RESECTION OF THE STRICTURED URETHRA.

The same conditions can be established in case a portion of the urethra has been entirely destroyed by inflammatory processes, leaving a cicatricial stricture, in which a recovery of the lumen of the urethra is impossible. In such case the cicatricial stricture is entirely excised and the urethra above and below is united by means of fine cat-gut sutures, the most superficial third of the circumference of the urethra being again left open. A retention catheter is introduced and the wound is dressed in the usual way.

Prognosis.—The prognosis in all of these cases which are treated for a long period of time after they have apparently completely recovered is relatively very good, provided no further gonorrhœal urethritis occurs. It is, however, to be remembered that these patients should return to the surgeon from time to time, so that he can determine the tendency to recurrence of stricture at a time when the condition can be most easily relieved, and in case any such tendency exists, it should be overcome by the careful use of sounds before it has reached an advanced stage.

VASECTOMY.

The excision of the vas deferens may become necessary on account of the presence of tuberculosis of this organ, which is not uncommon, or on account of the presence of a malignant growth (sarcoma extending to the vas deferens from the testicle being the most common cause), or the operation may be performed with a hope of causing a reduction in the size of a hypertrophied prostate gland. It is likely that this operation will be employed for the purpose of securing sterility in patients either physically, mentally or morally impaired to such an extent as to make their progeny dangerous to the community at large.

Operation.—The extent of the procedure will depend upon the condition for which it is to be performed. If a considerable portion of the vas deferens is diseased the incision should extend from the external abdominal ring down to the lower portion of the scrotum. The tissues of the cord being exposed, the vas deferens will be recognized as a hard, round cord. This, in case of the presence of malignancy, will be removed, together with all the tissues of the cord and the testicle. In case it is tubercular and the disease has not penetrated the organ and infected the surrounding tissues, it is separated from the adjacent parts to a point two centimeters or more beyond the affected portion. It is then ligated with cat-gut at each end and excised.

In case the entire vas deferens is tubercular it should be carefully dissected so far up into the inguinal canal as is possible without fear of breaking it off. A syringe with a blunt-pointed needle is then filled with ninety-five per cent. carbolic acid. The needle is introduced into the vas deferens and the carbolic acid is injected very slowly into its lumen. After the acid has been in contact for five minutes the syringe is filled repeatedly with strong alcohol, which is also injected through the lumen of the vas deferens in order to prevent the carbolic acid from causing too much destruction.

Should the operation be intended only for the interruption of the continuity of the canal, a small incision two centimeters in length is made opposite the external abdominal ring, the tissues of the cord are brought into the incision, the vas deferens is separated from the other structures of the cord, two cat-gut ligatures are applied a centimeter apart, and the intervening portion is excised. The tissues of the cord are then replaced and the wound in the skin is closed with one stitch.

Regarding the effect of this operation for the relief of hypertrophy of the prostate gland, I would say that there are undoubtedly certain patients who are permanently benefited by this form of treatment. It is, however, impossible to determine beforehand which patients will be so improved, and consequently it is impossible to make a reliable prognosis. The operation in itself is simple, it can easily be performed under cocaine anæsthesia, it is not accompanied with pain, and results in no deformity. All of these reasons make it one which should not be condemned, although the relative number of permanent recoveries is not sufficient to warrant its general adoption.

PROSTATECTOMY.

This operation has grown greatly in favor during the past few years, principally because attention has been paid to its careful technical development. It is performed entirely for the removal of hypertrophied prostate glands. I will only describe the perineal method of doing this operation, because the suprapubic method virtually corresponds to the operation for suprapubic cystotomy, to which is added the enucleation of one or more lobes of the enlarged prostate gland projecting into the bladder. For all cases of prostatic enlargement in which there is not a distinct projecting lobe into the bladder, I, personally, would perform the perineal operation.

In the consideration of this operation it must be remembered that the patients upon whom it is performed are usually advanced in years, because hypertrophy of the prostate gland occurs most frequently at such time. There has been in these cases an obstruction to the passage of urine, which has usually resulted in the accumulation of residual urine in the bladder, predisposing to infection of the urine and consequent cystitis. Many of these patients have infected their bladders mechanically by the use of septic catheters; in many of them these conditions have resulted in the formation of stone; in many of them the infection has advanced by one or both ureters into the pelvis of the kidney, giving rise to a pyelitis; and many again are found suffering from a chronic nephritis, which is not uncommon in patients advanced in years, though there may be no direct mechanical cause for its occurrence. All these facts would indicate that this operation, as a rule, is performed on a class of patients who are not well fitted to endure any serious surgical undertaking, a fact which must of course be borne in mind when this operation is suggested. The facts which are in favor of this operation in patients whose general condition is not good are:

1. That the patient will be relieved of pain.

2. The drainage of the bladder which follows the operation relieves the urinary obstruction and at the same time prevents further septic absorption from the residual urine.

3. The bladder is accessible to irrigation after this operation,

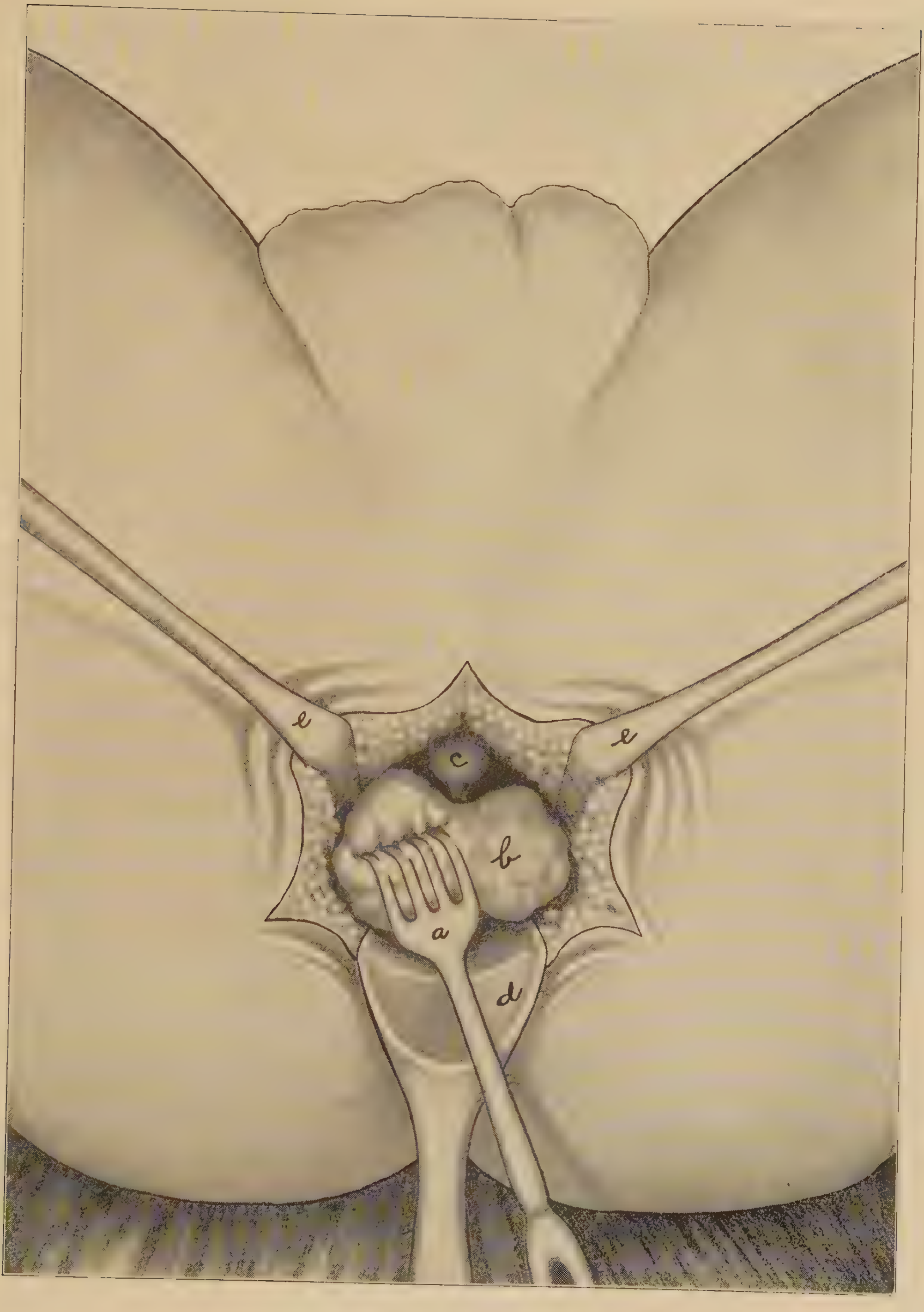


PLATE LXII.

PROSTATECTOMY.

A horseshoe shaped incision is shown with the two branches opposite the tuber-ischii. The flap is drawn backward by a vaginal speculum (d); the wound is held open laterally by the retractors (ee); the urethra is seen deep in the wound anteriorly at (c); the prostate gland (b) is drawn downward by means of the cat's-paw retractor (a).

so that any septic material which may be secreted from the walls of the infected bladder can be frequently washed away.

4. The patient is not exposed to the likelihood of infection in the future, which is almost inevitable if he is compelled to resort to the daily use of a catheter for the purpose of evacuating the bladder.

It remains now to reduce to the minimum the amount of traumatism required for the removal of the enlarged prostate gland. I believe that the operation herewith described fills this requirement.

Preparation for Operation.—It is important that patients about to undergo this operation should be carefully prepared in the manner described in connection with suprapubic cystotomy. These cases are almost all chronic in character when they reach the hands of the surgeon; consequently a few weeks spent in securing as aseptic a condition of their bladders as possible is not of much importance to them. It is not so much of a hardship to a man to postpone his relief for a few weeks, after he has suffered for a long time, as it would be if his suffering were acute, and I believe that the success in these cases depends to a very large extent upon the careful preparatory treatment.

Operation.—Before beginning the operation, the bladder is carefully irrigated with one of the mild antiseptic fluids which have been mentioned before in connection with bladder surgery, until the fluid returns perfectly clear. The bladder is then completely emptied by placing a soft rubber catheter so that it will act as a siphon and by making pressure upon the bladder above the pubis. The soft rubber catheter is then removed and a steel sound is introduced to the prostatic portion, but not through it, to act as a guide in locating the urethra. A horeshoe-shaped incision is then made from a point opposite the tuberosity of the ischium on one side to that on the other, the convex portion extending across the perineum, as indicated in Plate LXII. With a finger in the rectum and the steel sound in the urethra one can readily and safely make the dissection forward until the entire lower surface of the prostate gland is exposed, as shown in this plate. There are a few insignificant vessels which will be encountered, and from each side there will be one or more divisions of the internal pudic artery which will bleed freely, but it can be grasped either before or after division with hæmostatic forceps and ligated at once in order to leave the space entirely free. All of the smaller vessels may be grasped and also ligated, the important point in this portion of the operation being the complete, careful exposure of the prostate gland. A sharp-toothed cat's-paw retractor is then caught in one lobe of the gland and the latter is drawn downward. With a sharp scalpel the capsule of the other lobe is then incised deeply, care being taken not to approach the middle portion of the gland. A second retractor of the same kind is then inserted into the lobe which has just been incised, and the gland is kept drawn down while a second deep incision is made through the capsule of the second lobe. While the gland is still held downwards by means of the cat's-paw retractor, a finger is introduced into the incision which has just been made and one lobe of the gland is freed from its capsule, regard being taken not to approach the median portion. The retractor is then again changed to the other lobe, and the second lobe is enucleated with the finger, care being again taken not to approach the middle portion until the lobe has been entirely freed. In this manner a considerable amount of annoying hæmorrhage is avoided, which comes from the submucous veins at the neck of the bladder. In case the middle lobe is approached at first, these veins are likely to cause a sufficient amount of bleeding to cloud the field of operation.

One finger is now introduced behind each lobe, and by bringing the two fingers together posteriorly, the entire gland can usually be rolled out forward. The anterior attachment is then cut away with scissors, in order not to disturb the anterior portion of the prostatic urethra unnecessarily. A gauze pad is inserted at once to make a slight amount of pressure, which will cause the bleeding to subside readily.

A finger is then introduced into the bladder in order to determine the presence of one or more stones. Occasionally after a thorough examination of the bladder with a steel sound has failed to determine the presence of stones, the digital examination after the removal of the prostate gland will still demonstrate their presence. If stones are present the surgeon should determine whether the opening in the bladder is sufficiently large to permit their extraction. If this is not the case an incision is made posteriorly until the desired size has been obtained. The stones are then removed in the ordinary manner. In ordinary cases all that remains to be done is the introduction of a rubber tube, with numerous small perforations near the end, to the fundus of the bladder. This should be stitched into the angle of the wound. A piece of iodoform gauze may then be tamponed against the remaining portion of the capsule of the prostate gland and permitted to protrude from the wound of the perineum near the point at which the drainage tube issues. A few stitches are then applied to replace the flap.

I believe that it is best not to suture the flap too tightly, because there will be a considerable amount of oozing, and if there is a sufficient amount of space for drainage to take place the patient will be saved the possibility of the accumulation of wound secretion. If the bladder has been severely infected I believe it is better to introduce two drainage tubes a little smaller in size to the fundus of the bladder so that irrigation may be accomplished by injecting the irrigating fluid through one tube and permitting it to escape through the other after the operation. In case there should be a considerable amount of hæmorrhage from the capsule—which, however, is not common—this may be controlled by the application of a few hæmostatic forceps, which are permitted to protrude through the wound, and which can be removed after twelve or twenty-four hours with safety. If there is considerable oozing the space may be tamponed with a sufficient amount of iodoform gauze to overcome it, but it does not frequently happen that the tissues require this form of tamponing.

After-Treatment.—The bladder should be irrigated with one of the various mild antiseptic fluids from one to six times a day, according to the condition of the viscus wall. The iodoform gauze is withdrawn after the second or third day, and from the fifth to the tenth day the rubber drainage tube is removed. In many cases the patient has no difficulty after this time with evacuating the bladder normally, but in case the flow of urine is not normal it is wise to introduce a soft rubber catheter through the urethra into the bladder for a few days. It is well to remove it every second or third day to see whether the normal conditions have been established, and if they have not, the catheter can be replaced. During this period it is well to give some mild antiseptic internally and to give the patient large quantities of pure water, in order to dilute the urine. It is well to encourage him to sit up the second or third day after the operation, and to get out of bed as soon as possible, because men at this age do not bear confinement very well.

PROGNOSIS.—Bearing in mind the condition of these patients, aside from the condition of the prostate gland, they withstand this operation remarkably well, and the difference in the comfort of the patient and the improvement in his general condition is very marked. In many cases the free drainage seems to improve the function of the kidneys decidedly, so that after a few months a marked albuminuria may almost entirely disappear. The fact that a constant source of septic infection has been removed is of very great importance to the general health of the patient. I believe that this operation will add many years to the lives of these sufferers.

COMPLICATIONS.—Occasionally it will be found that the existing adhesions prevent the enucleation of any considerable portion of the prostate gland, and that in order to remove it in the manner which has just been described it will be necessary to produce too severe a traumatism; consequently if it is found impossible to enucleate the lobes of the prostate as described, the following method should be substituted.

The operation is performed as described above to the point of enucleation. This is attempted, but if it proves unsuccessful, the sharp-toothed cat's-paw retractor is applied to one lobe, as indicated in Plate LXII, and the substance of the gland is removed piecemeal with cutting forceps. The extent to which it has to be removed can easily be determined by inserting the finger into the field of operation from time to time. The operation is more tedious than enucleation, but much safer than in cases in which enucleation cannot be readily accomplished. The drainage of the bladder and the after-treatment are the same as described before.

PROSTATOTOMY.

This operation is performed for the relief of abscess of the prostate gland. In young individuals with an infection of the prostate gland, due to specific urethritis, it is often found that the prostate gland is filled with multiple abscesses, which will keep the patient in a slightly septic condition for a long period of time. This infection may progress to form larger abscesses, but these usually have for their existing cause the introduction of steel sounds or bougies. The abscess may increase in size to such an extent as to produce a swelling in the region of the perineum, or it may produce a fluctuating tumor in the rectum. This condition is accompanied with severe pain and symptoms of acute suppuration. In the presence of a large abscess that causes a swelling in the region of the perineum, this should be opened through a perineal section, being careful not to injure either the rectum or the urethra. It is well to make the incision quite into the prostate gland, to curette away the infectious material, and to tampon the cavity with iodoform gauze. In case the fluctuation can be discovered by digital examination through the rectum, the incision which has just been described may be used, or the swelling in the rectum may be exposed by the use of retractors and the abscess may be opened into the rectum by the use of the actual cautery. In this event, the opening should be made large enough to insure permanent drainage. The opening will increase in size if it has been made by means of the cautery, because the eschar which is formed throughout the circumference of the opening will fall off as healing progresses, and will thus increase this aperture.

Much has been said against the opening of prostatic abscesses into the rectum for fear of infection. If the wound has been made as just described, and if the patient has received proper preliminary treatment, consisting in the administration of two ounces of castor oil for two successive days previous to performing the operation with a thorough repeated flushing of the bowel before the operation, and if the operation is followed by the proper after-treatment, consisting in the administration of a saline laxative daily and thorough flushing after the evacuation of the bowels, then, according to my experience, this operation will be perfectly satisfactory. It is quite different if the abscess is simply incised, especially if the preliminary and after-treatment are not carried out with care. In the presence of multiple small abscesses of the prostate gland, resulting from repeated infections from gonorrhœal urethritis, the gland is exposed as in the operation described for perineal prostatectomy. Then it is drawn down as indicated in Plate LXII and a deep incision made transversely across each lobe of the prostate, and this is carefully tamponed with iodoform gauze. A small rubber drainage tube is introduced to each lobe of the gland, but not into it, and the wound is closed with sutures, with the exception of the two lower angles through which the rubber drainage tube and the iodoform gauze issue.

Prognosis.—This operation may result in the complete relief of the patient, especially if he has not the misfortune of acquiring a further gonorrhœal urethritis. In many cases, however, the recovery is not permanent, and it will be necessary to perform a prostatectomy in order to give the patient permanent relief.

EPIDIDYMECTOMY.

In a majority of cases of tuberculosis of the testicles the latter is involved secondarily, the primary tuberculosis being in the epididymis, and in many cases in which the testicle is supposed to be tuberculous a careful examination will reveal the fact that the disease is still confined to the epydidymis. If this is the case, it is, of course, not necessary to disturb the testicle during the operation, which should simply consist in making a wedge-shaped excision of the epididymis, together with the vas deferens, which is usually involved in these cases, and to close the defect with fine cat-gut sutures. Even if there is a moderate infection of the testicle, a conical excision of the diseased area may be made when the epididymis is removed, and the defect may be closed with buried cat-gut sutures. It is only in case of multiple tubercular foci in the testicle in which it seems impossible to preserve any portion of the organ in which the multiple puncture with the actual cautery is indicated, because with this method it is possible to preserve a remnant of the organ, even if apparently the entire organ has been destroyed by the tuberculosis.

It is plain that a wound made in this manner cannot heal so quickly as a clean cut one, but the patient is very willing to undergo the necessary annoyance in order to secure the resulting benefit.

The cicatricial tissue which develops as a result of the cauterization seems to do much to prevent the further destruction of the organ by tuberculosis.

CASTRATION.

This operation is indicated for the relief of malignant disease of the testicle, for gangrene, or for traumatism, which would inevitably result in gangrene of the organ, for destructive suppuration, and for very extensive unilateral tuberculosis.

If tuberculosis occurs in both organs simultaneously, or in the remaining organ after the other one has been removed, for any reason, I have never found it necessary to perform this operation, but have substituted the destruction of the diseased portion by means of the actual cautery. Even in cases in which only a very slight amount of the tissue can be preserved I have found this of very great value to the patient. This is true even in cases in which it was necessary to remove the epididymis, together with the vase deferens. So long as it was possible to preserve the seminal vesicles there has been no mental depression in these cases on account of the partial destruction of the testes with the actual cautery, together with the removal of the vas deferens on both sides. It is quite different in case of double castration in patients too young to have passed beyond the virile period normally. Double castration, in my experience, has resulted in permanent relief from urinary obstruction due to hypertrophy of the prostate gland in about fifty per cent. of all cases in which I have made use of this method. There is, however, no definite guide that will indicate which cases are likely to be benefited. Moreover, the operation results in a deformity which is very repulsive to many patients, even though past the virile stage.

It seems as though this method should receive definite recognition, but since perineal prostatectomy has been so much simplified, and its safety has been so greatly enhanced, it appears doubtful whether castration for the relief of prostatic hypertrophy will continue to be employed to any great extent.

TUMORS OF THE TESTICLE.

The most common forms of tumor of the testicle are the sarcoma, enchondroma and teratoma. All other forms of tumors may occur, but they are not common. Tumors should be differentiated from gumma, inflammatory swelling, hydrocele with an unusually tense sac, or a sac which has undergone calcareous degeneration, scrotal hernia with incarcerated omentum, tuberculosis of the testicle and epididymis and simple hyperplasia of the testicle.

The most common error occurs in connection with gumma of the testicle, which is not a very uncommon condition. It is frequently necessary to place the patient under vigorous antisyphilitic treatment for a few weeks in order to positively clear up the diagnosis. Tuberculosis can usually be eliminated more easily because of the nodular condition of the swelling and the tendency to breaking down of portions. There is usually also a tubercular history in these cases, and the progress of the disease is relatively very slow.

The differentiation between hernia and hydrocele has been discussed in connection with these subjects.

Operation.—An incision is made through the skin from the external abdominal ring downward to a point near the lower edge of the scrotum; then the entire organ, together with the tunica vaginalis, is enucleated. A pair of heavy clamp forceps is applied just outside of the external abdominal ring, then the tissues of the cord are dissected out in the inguinal canal. In case the tumor is quite advanced, the incision in the skin may be carried to a point opposite the internal abdominal ring, and the incision may be carried through the deep fascia and the fascia of the external oblique abdominal muscle exposing the tissues of the cord throughout the entire distance of the inguinal canal. In this case the tissues of the cord are dissected out to this point.

The vas deferens is then separated from the remaining tissues of the cord, ligated with cat-gut, cut and permitted to retract within the internal abdominal ring. The remaining structures of the cord are then separated and the various larger vessels are ligated and cut separately and successively permitted to retract beyond the internal abdominal ring. Then the remaining portion of the cord is ligated en masse and cut. In this manner one can easily guard against secondary hæmorrhage. All bleeding points are carefully caught and ligated. A small drain is inserted in the lower angle of the wound in order to prevent the accumulation of serum from the large surface. The wound is then sutured and an ordinary dressing is applied and held in place, preferably by a properly constructed suspensory bandage.

In case the malignant growth has invaded the skin, or the other side of the scrotum, the same should be entirely removed, provided it seems likely that the disease is still localized. Unfortunately metastases usually occur in these cases before they have advanced to the point of invading the surrounding tissues; hence the prognosis is usually hopeless when this condition is present.

If the operation is performed without the use of unnecessary traumatism, it is usually not followed by any severe degree of shock. In patients advanced in age, however, the shock is sometimes quite considerable, and many surgeons have reported the occurrence of acute melancholia, which, it seemed, was not due to sepsis in some.

In young patients this operation very frequently gives rise to mental depression, and should not be employed if there is any possibility of avoiding it.

In these cases the deformity may be corrected by inserting into the scrotum a properly shaped mass of paraffine or a hollow structure composed of celluloid of the same form.

One of these devices seems to be of considerable value to neurotic subjects, and if a patient seems inclined to be neurotic it may be well to make use of this plan at the time of the original operation.

AMPUTATION OF THE PENIS.

This operation is performed only for the relief of malignant growths which, in my experience, have always been carcinomatous in nature, although there is no reason why other forms of malignant growths should not occur in this organ.

If the disease is confined to the distal end, it may be so circumscribed as to be completely removable by the amputation of only a portion of the organ, but if any doubt exists it is much safer for the patient to make the complete amputation at once, together with a thorough removal of the inguinal lymphatic glands.

In case the condition present seems to warrant the removal of only a portion of the organ, the following method should be employed:

A small rubber tube is stretched and passed several times around the penis near its pubic attachment and tied, in order to make the operation bloodless. A point is then chosen sufficiently far from the tumor to insure freedom from invasion. Usually this distance should be at least five centimeters; and the greater the distance the better, because these growths are exceedingly prone to recur in this region. After the point for amputation has been chosen the skin is divided with a circular incision two centimeters nearer the pubis. Then a sound is introduced into the urethra and a cat-gut suture is pasesd around each corpus cavernosum, and another around the corpus spongiosum down to, but not through, the urethra, which can be determined by the presence of the sound in the canal. These ligatures are carefully tied. Then a circular incision is carried down to, but not through, the urethra, one centimeter away from the point at which the ligatures have been applied, in a distal direction. Then the tissues are stripped from the urethra for a distance of one centimeter in the distal direction, and then the latter is severed.

Now the dorsal artery is caught separately with hæmostatic forceps and ligated. Then the elastic constrictor is removed and the stump will be found entirely free from hæmorrhage. The projecting portion of the urethra is then split laterally, and carried through a buttonhole in the anterior skin flap, where it is sutured in place with horse-hair sutures. The skin is then drawn over the stump of the penis, and a tenaculum is applied on each side, thus forming a transverse wound. The edges of the skin are united and a complete covering of the stump is formed in this manner. The arrangement of the flaps at the end of the urethra will prevent the contraction of the canal at this point.

This operation leaves the patient in a very comfortable condition, but unfortunately these sufferers do not come under the care of the surgeon early enough, as a rule, to make the procedure justifiable.

Fortunately, the more complete operation gives satisfactory results, both as regards permanency of cure and function of the urethra, even in advanced cases. This operation is, however, much more extensive and correspondingly more severe as regards the production of shock. It contemplates the removal of the entire organ, together with the scrotum, with its contents, and the tissues of the spermatic cords, together with the inguinal lymphatic glands. It also includes the transplantation of the remnant of the urethra into the perineum.

Operation.—An incision is begun opposite the internal abdominal ring on one side. It is carried down over the center of the inguinal canal around the edge of the scrotum, sufficient skin being left to insure the covering of the entire defect. Then the incision is carried up on the opposite side along the edge of the scrotum over the inguinal canal to a point opposite the other internal abdominal ring. A transverse incision is made to join the two just described, just below the pubis. The skin and superficial fascia are then dissected up and all the inguinal lymphatic glands are carefully excised. The tissues of the cord are then isolated and treated as described in the operation for castration. The bleeding vessels are carefully caught with hæmostatic forceps, in order to reduce the loss of blood to a minimum. It is desirable to make a very thorough dissection of the entire inguinal region, in order that no infected lymphatic glands remain. The suspensory ligament is severed from its attachment to the pubic bone and then the crura are loosened from their attachment to the rami of the pubis.

It now becomes necessary to insert a sound into the urethra, and the latter should be dissected out to a length to project half a centimeter beyond the level of the lateral skin flaps. After isolating this length of urethra it is cut off at right angles, and now the remaining tissues are loosened from their attachment backward. The branches of the internal pudic arteries should be caught before they are severed, because quite a little blood can be saved in this manner. All the blood vessels are then carefully ligated. The remnant of the urethra is split anteriorly and posteriorly to a distance of one-half centimeter, and is sutured directly into the lower edge of the wound in the perineum. A small retention catheter is introduced into the bladder and the incisions in the skin are closed throughout with sutures. If the dissection in the inguinal region has been quite extensive it is well to insert a small drainage tube on each side, in order to prevent the accumulation of serum. Ordinarily, however, the application of thoroughly fitting pads will make this unnecessary. An ordinary dressing is applied to the wound and a retention catheter is attached to a rubber drain, which is inserted in a bottle containing some antiseptic fluid.

This operation is usually performed in aged patients, and consequently it is important that it should be performed quickly and that as little traumatism as possible be inflicted.

After-Treatment.—I have found it advantageous to permit these patients to sit up soon after the operation, on the second or third day, because this will not interfere with the healing, and these patients are prone to have hypostatic congestion, which can be avoided in this manner.

The retention catheter is removed on the second or third day and the patient is permitted to evacuate his bladder spontaneously. In some cases I have permitted this from the beginning with perfect satisfaction.

Prognosis.—My personal experience with this operation has been confined to four cases, all of which had been previously operated for the relief of carcinoma, and in all of them there was not only a recurrence of the disease in the organ, but also a recurrence in the inguinal lymphatic glands. To my surprise, none of these

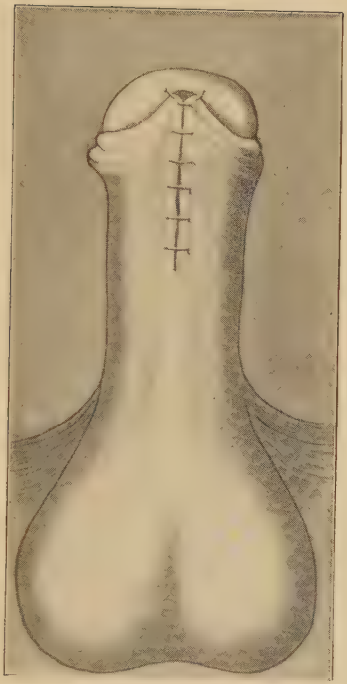


Fig. II.

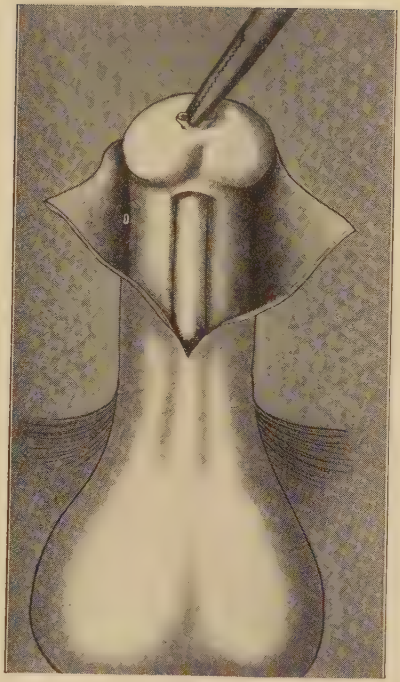


Fig. I.

PLATE LXIII.

HYPOSPADIAS OPERATION.

Fig. 1 represents the flaps of the foreskin reflected; the urethra carefully dissected free; a perforation has been made through the glans by means of a trocar; the end of the urethra has been caught with fine pointed hæmostatic forceps and carried forward through the opening in the glans.

Fig. 2 represents the flaps sutured in place, making an artificial frenulum, the end of the urethra having previously been sutured in position a little above the center of the glans.

Taken from Dr. C. H. Mayo's original drawings.

patients has died as a result of a recurrence. The first patient lived for three years and died of pneumonia. The second patient lived for a period of six years without recurrence and died of an intercurrent disease. The third is alive after five years; and the fourth is too recent to be of any importance in this consideration, the operation having been performed not much over one year ago, but he, also, is free from recurrence. In all of these the operation was performed with the greatest thoroughness, although each case at the time of the operation seemed hopeless, judging from experience with carcinoma in other regions of the body after the lymphatic glands have been involved.

HYPOSPADIAS.

This deformity is so common that it seems proper to describe a simple method for its relief, especially as the presence of the defect seems to give rise to much mental suffering on the part of the parents of the afflicted child.

The urethra may open just at the beginning of the glans and then the operation to be employed is exceedingly simple.

"An incision is made through the skin in the median line from its opening to a point from one-third to one-half the distance to the scrotum. Skin flaps are then dissected to either side, as shown in Plate LXIII, Fig. 1. The urethra is then dissected perfectly free this entire distance back, great care being taken not to injure its delicate wall at any time. The glans is then transfixed in the direction of the urethra by means of a very sharp trocar three millimeters in diameter. Caution should be taken to place this opening two to three millimeters above the small dimple in the center of the glans, which marks the point at which the meatus was normally intended, because if this is not done the organ will curve downward and there will still exist an uncomfortable deformity.

A pair of fine hæmostatic forceps is then passed through the canal which has been made in the glans in this manner and the urethra is drawn through the opening in the manner shown in Plate LXIII, Fig. 1. It is then carefully sutured in place with two rows of cat-gut or fine silk sutures. The lateral skin flaps are then united as shown in Plate LXIII, Fig. II. In this manner the deformity can be almost completely corrected and the functional conditions are very greatly improved. The tissues in this region are so elastic that they readily accommodate themselves to these new relations, and the results of this operation are very satisfactory.

In case the urethra opens far back from the glans, another method is indicated which will supply a new urethra artificially formed out of the tissues of the prepuce, as shown in Figs. I and II, Plate LXIV."

The prepuce in cases of hypospadias is usually redundant and situated on the dorsal surface, overhanging the glans like a hood. The skin of the penis is noted for its thinness, having no adipose tissue, also for its looseness of attachment and elasticity. Where it is folded upon itself at its cervical attachment its character very nearly resembles mucous membrane.

The prepuce is extended as for circumcision, and two incisions are made, about one inch apart, extending from its free border to its attachment at the penile cervix; the prepuce is unfolded, forming a loop of thin skin about six centimeters in length. Should this not be considered sufficient to reach from its attachment to the hypospadiac opening, the two incisions are extended back along the dorsum of the penis until sufficient tissue is obtained, when the two incisions are connected by a transverse one, and the flap of skin lifted, but left attached to the cervix by the inner surface. Several sutures now close the lateral integument of the penis over the denuded area. (Plate LXIV, Fig. I.)

The pediculated flap of prepuce is constructed into a tube with its skin or outer surface inside, by means of a number of cat-gut sutures. The penis is tunneled by means of a narrow bistoury or medium trocar and cannula, through the glans, above its groove, along the penis to a point beneath the hypospadiac opening, when it is made to emerge at one side of, but close to, the urethra; the tube of prepuce is drawn through the tunnel and sutured where it enters the glans and also where it emerges. (Plate LXIV, Fig. II.) At the end of ten days the flap of pedicle is cut through close to the new meatus. The second operation, made at a later period, consists of a perineal opening into the urethra and insertion of a Jacobs'

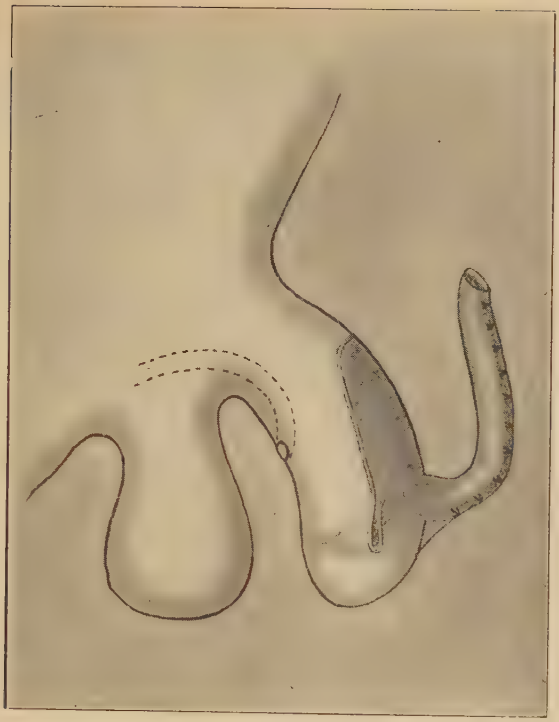


Fig. I.

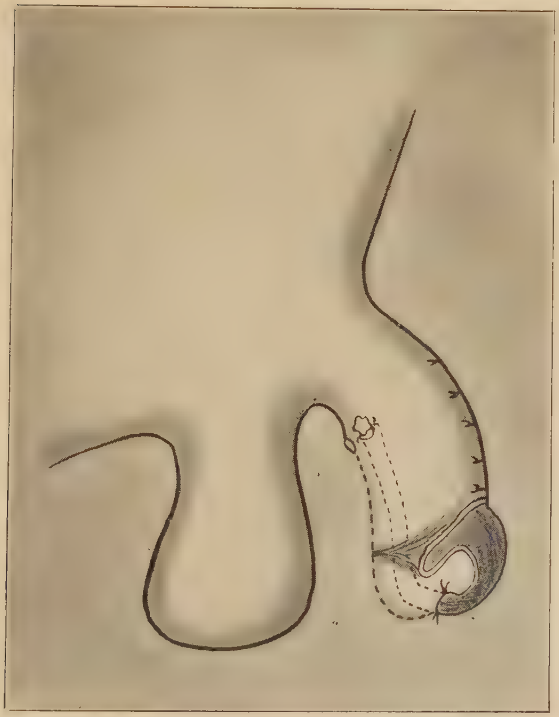


Fig. II.

PLATE LXIV.

HYPOSPADIAS.

Fig. I represents the prepuce and a portion of the skin from the dorsal surface of the penis dissected up and formed into a canal, with the cuticle turned in for a lining. The urethra is indicated by dotted lines. It opens on the inferior surface of the penis.

Fig. II represents the glans and the penis tunneled and the newly formed urethra drawn through and the defect upon the dorsal surface of the penis closed with sutures.

Taken from Dr. C. H. Mayo's original drawings.

self-retaining female catheter; this is the least irritating and can be left as long as needed, usually from five to eight days. An incision at the termination of the two urethras now admits of accurate coaptation by sutures, or the normal urethra may be mobilized to a sufficient extent to admit of its insertion into the caliber of the new urethra, where it is held by sutures and the external parts closed over this. Occasionally a little urine escapes into the urethra and the entire canal is best drained by passing several silkworm strands of horsehair through the urethra and out alongside the catheter in the perineal opening. When union of the canals is complete the drains are removed and the perineal drainage will usually close itself in a few days. Horsehair and fine cat-gut have proved the best suture material for this form of plastic work.

The advantages of this combined operation are:

1. A urethral tube of thin, elastic skin, nearly approaching mucous membrane, yet having no hair surface to occasion later complications.

2. A perineal drain for the bladder, with a self-retaining Jacobs' female catheter.

3. A silkworm drain for the urethra; and

4. In being a method capable of application to the worst types of hypospadiac cases."

EXSTROPHY OF THE BLADDER.

The condition of exstrophy of the bladder is so distressing that I will describe an operation which promises to become generally adopted, although my personal experience is still too small to warrant me in recommending it on that ground. The entire number of cases which have been operated by this method is also quite small, and in many of them the ultimate result has not been reported, but all the operations which have been in use before the introduction of this one can be applied in only a small number of patients and do not promise very satisfactory results at best, while this operation seems so far to be most satisfactory.

Preparation for Operation.—Two days before the operation the patient is given two ounces of castor oil, in order to remove as much of the mucus and other contents of the alimentary canal as possible with slight irritation. From this time on until the operation is performed, the patient is given only concentrated sterilized food, in order to leave the alimentary canal in as nearly an aseptic condition as can be. No enema is given until the patient is anæsthetized; then the rectum and colon are very thoroughly irrigated with boric acid solution, and after the water returns perfectly clear the sphincter ani muscles are stretched very gently, but very thoroughly. Then the rectum is once more thoroughly irrigated. The patient is then placed in the Trendelenburg position and the bladder is carefully disinfected. The bladder is then loosened from the abdominal wall throughout the entire distance, two fine probes are inserted into the ureters, great care being taken not to disturb the littlle valve-like openings at the end of the ureters. Then an elliptical portion of the bladder wall, from two to three centimeters in diameter, is excised in such a manner that the openings of the ureters are as near the middle of this portion as possible. Care must be taken in this step of the operation not to injure the ureters. It is best to begin the incision below and then to lift up the portion of the bladder and to observe the direction in which the probes extend into the ureters. In this manner injury to the latter is readily avoided. The segment of the bladder, together with the ureters, is now held upwards, the urine which issues from the ureters is sponged gently, and the remaining portion of the bladder is rapidly dissected away. Then the sigmoid flexure is brought up into the wound and a longitudinal incision is made through the middle of the longitudinal muscular band, two centimeters in length. The segment of four silk stitches is inserted into the colon, two at the end of the longitudinal incision in the colon and one in each edge of the incision half way between these two stitches. The four sutures are to be utilized for the purpose of manipulating the intestine while the segment of the bladder is sutured in place. The first row of sutures is passed through the entire thickness of the bladder and through the entire thickness of the intestine, care being taken to repeat about the fourth stitch in the continuous suture in order to prevent slipping—after the manner which has been described in intestinal surgery. After the entire segment of the bladder has been sutured into this opening, with the mucous membrane facing the lumen of the intestine, then a second row of sutures is applied which penetrates neither the portion of the bladder nor the intestine, but simply grasps a sufficient amount of tissue to bring the serous surfaces carefully and thoroughly in apposition throughout the entire course. The intestine is then dropped into the abdominal cavity. Care must then be taken to isolate the layers of the abdominal wall because the latter is bound to be defective in these cases, and if this precaution is not taken a ventral hernia is very likely to result. After these layers have been carefully isolated the abdominal wall is closed in the manner described in the chapter on abdominal surgery.

It is of great importance in these cases to strap the wound thoroughly with rubber adhesive straps, in order to remove the tension as much as possible from the stitches in the abdominal wound. It is also important to administer for the first two weeks after the operation only such food as will give rise to the formation of as little gas as possible, in order to reduce the strain upon the stitches of the abdominal wound to a minimum. The stretching of the sphincter ani muscle in the beginning of the operation will aid in preventing accumulation of gas and will reduce the pressure upon the wound in the intestine. Should, however, the sphincter contract sooner than desirable a rectal tube should be inserted and kept freely open, in order to prevent the accumulation of flatus in the rectum. As stated before, my personal experience is still too limited to warrant a recommendation of this operation on this ground, but in the cases in which I have employed it the operation has been most satisfactory.

Surgery of the Rectum.

HÆMORRHOIDS.

Patients suffering from hæmorrhoids usually give a history of long-continued, habitual constipation. The patient's occupation is usually sedentary and the diet complicated and unhygienic, the development of hæmorrhoids resulting from obstruction to the return circulation through the hæmorrhoidal veins. This obstruction may be local, due to accumulations in the rectum or due to the presence of tumors in the pelvis. Pregnancy is a common cause, or it may be the result of obstruction in the hepatic circulation.

Diagnosis.—The patient gives a history of suffering from a feeling of fullness in the region of the hæmorrhoidal veins. This may be accompanied with occasional hæmorrhages, which give temporary relief to such sensation. If the condition has existed for a prolonged time there is a protrusion of mucous membrane containing distended hæmorrhoidal veins at each evacuation of the bowels. These masses may become replaced spontaneously, or may have to be returned mechanically. Upon digital examination soft oval masses will be felt, varying in number from one to six or eight, although there are usually not more than three or four. Some of these masses are usually larger than others. They may acquire a considerable size sometimes, rather more than an inch in diameter. In many cases there is a constant secretion from these surfaces, giving rise, on account of its irritating character, to an eczema. After the hæmorrhoids have existed for a time, the patients usually complain of a constant burning sensation in this region.

Treatment.—In many cases simply regulating the diet, securing a regular free evacuation of the bowels each day, and applying some soothing ointment or suppository, together with the use of

Sitz baths or shower baths, will result in relief to this condition. If, however, it has existed for a long period of time this will usually not suffice, and an operation will have to be employed in order to secure permanent relief.

Preparatory Treatment.—The patient should be cautious to eat only easily digestible food in very moderate quantity, to take a mild saline laxative every day for several days previous to undergoing the operation, and on the day before the operation he should be given two ounces of castor oil, followed in the same evening and on the following morning with large flushings of the colon. In this manner the alimentary canal can be quite thoroughly freed from material which might otherwise irritate the wound surfaces after the operation.

Operation.—In my own experience the following operation has proved exceedingly satisfactory in almost every case. The patient being anæsthetized and placed in the lithotomy position the sphincter ani muscles are very thoroughly dilated by introducing the thumbs beyond the internal sphincter and stretching very slowly, but very thoroughly. The slow progress of the stretching will prevent the tearing of the mucous membrane unnecessarily. The stretching should be continued until the sphincter remains lax after the stretching has ceased. Each hæmorrhoid is then caught with two pairs of hæmostatic forceps placed in a straight line with the direction of the rectum, the outer one being placed from one to two centimeters, the second from two to four centimeters, from the margin of the anus. A clamp is then applied to the hæmorrhoid beneath the attachment of these forceps, also in the direction of the rectum. If it is convenient a clamp which is protected on its lower side with some bad conductor of heat, such as ivory, bone or rubber, is to be preferred, otherwise an ordinary pair of long-jawed hæmostatic forceps will serve the purpose very well. The surrounding tissues should be protected by placing underneath the forceps a piece of asbestos cloth, or if this cannot be procured, a piece of gauze folded half a dozen times upon itself and immersed in cold water may be placed underneath the clamp. The projecting portion of the hæmorrhoid is then carefully seared by means of a cautery. It is preferable not to cut away the projecting portion and to cauterize the small portion left beyond the forceps, because if the entire hæmorrhoid is thoroughly baked with a cautery which is not too hot there is never any danger from subsequent bleeding, which is not the case when the top of the hæmorrhoid has been cut off first and the cautery applied later. Any cautery will serve the purpose, but the one which I have found of the greatest service consists in a simple small-sized soldering iron, which is heated in a tinsmith's heater or in an ordinary gas flame, or in a coal stove or over an alcohol lamp. It is much more economical than any of the gasoline or electric cauteries, it is never out of repair, and can be easily procured anywhere. The successive hæmorrhoids are then picked up in the same manner and treated alike.

The main vessels come down in three groups, one anteriorly and two laterally. If these are caught in three masses and cauterized, the remaining hæmorrhoids will usually disappear spontaneously. It is important in applying the clamps always to leave at least half an inch of normal mucous membrane in order to avoid the production of stricture.

It is not wise to cauterize a hæmorrhoid exactly in the median line in front in a male on account of its close proximity to the urethra, because it frequently happens if this is done that there will be obstruction to the passage of urine for several days after the operation, which may prove exceedingly annoying, and if a hæmorrhoid at some small distance to one side of the median line is caught the one which may exist exactly in the median line, and which may be larger than either of the others, will disappear spontaneously. It happens occasionally that there is but one hæmorrhoid, and that this is just in the median line, and then, of course, it will have to be clamped in order to secure relief. It is of very great importance that if the clamp and cautery method is used the clamp should always be applied parallel with the direction of the rectum, because if it is applied transversely the patient is almost certain to suffer from the formation of a stricture.

In selecting a clamp it is well to avoid an instrument with sharp serrations, because these would be likely to injure the delicate veins, giving rise to troublesome hæmorrhage. Even with a properly constructed clamp care must be taken not to lacerate the veins.

In case no clamp of any kind is available, and it is desirable to relieve a patient of hæmorrhoids, this may be accomplished by the following plan, which I believe is quite as satisfactory as the clamp and cautery method, but I personally have not performed it nearly so often, having become accustomed to the other procedure.

The preparatory method and dilatation are just the same as in the operation immediately before described. The hæmorrhoid is picked up in the same manner. It is then transfixed with a needle armed with a double silk or cat-gut ligature about thirty to forty centimeters in length. The needle is then cut away and the ligature tied upwards underneath the second forceps. With scalpel or scissors the mucous membrane is then carefully cut transversely at the margin of the anus and the second ligature is tied in the groove which has thus been formed. The projecting portion of the hæmorrhoid is then cut away, only a sufficient amount being left in place to prevent slipping of the ligature. This method is applied to each hæmorrhoid in succession until all have been removed.

Dressings.—The patient is much more comfortable and the wound will heal quite as satisfactorily if no dressing is applied after either the clamp and cautery or the ligature method. For a considerable time I habitually applied some form of tampon or drainage to the rectum after operating for hæmorrhoids. This was decreased in amount constantly with increasing comfort to the patient, until at last we discarded this form of dressing entirely, and for a large number of these cases we have applied no dressing, except a little ordinary pad to the external parts held in place by a T bandage, for the purpose of absorbing any secretion which may occur.

After-Treatment.—The patient is kept on liquid diet for four or five days. At the end of this time a cathartic is given and before this causes an evacuation a large soap and water enema is administered through a soft rubber catheter. This is repeated after the cathartic has acted. From this time on a small saline laxative is given every morning, and the evacuation is followed by the use of the soap and water enema. The patient is confined to his bed for about a week. In unusually severe cases the excision of the entire rim of hæmorrhoidal tumors may be practised, although this is but very rarely necessary. Even in very extensive cases the results, after the application of the clamp and cautery to three or four of the largest hæmorrhoids, are very satisfactory, the other hæmorrhoids disappearing shortly after the operation has been performed. In case, however, it seems desirable to choose a still more thorough operation the following method will bring a satisfactory outcome.

An incision is made at the margin of the anus and the mucous membrane, together with the enlarged hæmorrhoidal veins, dissected out carefully for a distance of two to four centimeters. The mucous membrane of the rectum is then drawn down from above and about eight interrupted cat-gut stitches are applied at regular intervals, reaching through all the coats of the intestine down to the mucous membrane, but not through it, and through the subcutaneous connective tissue at the margin of the anus. These stitches should be so applied that after the portion of the rectum containing the hæmorrhoids has been cut away there will be still a slight projection of the mucous membrane of the rectum beyond the margin of the anus. All bleeding points are caught during the operation and carefully ligated with fine cat-gut. After the intestine has been sutured in place in this manner the projecting portion is cut away and the mucous membrane of the intestine is sutured accurately to the skin, the normal portion projecting a little beyond the margin of the latter. If the eight stay sutures which were first applied are carefully placed their pressure will control the hæmorrhage from the hæmorrhoidal veins, so that there will be no bleeding when the projecting portion is cut away.

The treatment after this operation is the same as after the operations which have been just described.

This last operation is very attractive, but in the vast majority of cases it is unnecessary.

Prognosis.—It does not matter which operation has been chosen, the prognosis will depend largely upon the hygienic conditions which the patient provides for himself. If proper food is taken, if constipation is avoided, and if proper exercise is enjoyed, the patient will remain permanently cured, which is not likely if these conditions are neglected.

FISSURE IN ANO.

One of the most painful affections encountered and which frequently accompanies the presence of hæmorrhoids, or is secondary to the latter, is fissure in ano, which is a small lesion extending parallel with the rectum, and consequently at right angles with the sphincter ani muscles. It is this last fact which causes this condition to resist treatment, because the wound constantly gives rise to spasmodic contractions of the sphincter ani muscles, and these in turn crush the surface which is already sore. The evacuation of the bowels is likely to open the wound which may have begun to heal during the interval, and the accompanying pain gives rise to spasmodic contraction of the sphincter muscles; consequently the patient suffers severely for some time after the bowels have been evacuated. The application of remedies to this condition is of very little benefit, for the reasons which have just been mentioned. Unless the condition is but very slight an operation must usually be resorted to before the patient can be properly and completely relieved.

Operation.—The operation in moderate cases consists simply in thoroughly dilating the sphincter ani muscles so that the wound may remain at rest for a few days. At the end of this time it will have healed spontaneously. If, however, the fissure has existed for a number of months or years, the amount of cicatricial tissue formed along its course may be considerable, and then the simple operation of stretching the sphincter ani muscle may no longer suffice to give relief. In such case the muscles should be stretched very thoroughly, and then the cicatricial tissue should be excised and the mucous membrane brought down from above and attached to the wound at the margin of the anus with a few fine cat-gut sutures. This simple method has, in my experience, resulted in the relief of even very severe cases which had existed for a long time.

After-Treatment.—The after-treatment is the same as in the case of operation for hæmorrhoids.

FISTULA IN ANO.

It is but rarely that a patient suffering from fistula in ano comes under the care of a surgeon during the early part of his disease. He has usually suffered for months or years, and has made use of various local remedies without benefit.

History.—The patient gives a history of having suffered from an acute infection in the ischio-rectal fossa, which resulted in an abscess, variable in size, the latter opening spontaneously or being opened by an incision. Before the occurrence of this infection there is generally found a history of hæmorrhoids. There has usually been a discharge of pus from the opening for a considerable period of time, and during this period the patient has been fairly free from pain. Then the opening would close and there would be a reaccumulation of pus within the abscess, again provoking much suffering. These conditions may have existed for a greater or less extent of time, and there may have been a variable number of occurrences of the reaccumulation of pus. There may be but one external opening, or the openings may be numerous. Quite a considerable proportion of these cases give a history of cough, and upon examination some evidence of pulmonary tuberculosis may be established.

Examination.—The usual practice of introducing a probe into one of these fistulæ is, I believe, to be condemned, because it gives rise to an amount of pain, it may produce a new infection, and it does not afford the surgeon any information which he cannot obtain by simply looking at the external surface.

Treatment.—The treatment in these cases should invariably be surgical, although a long-continued attention by means of applications, curettements and irrigation may in very rare cases result in a cure of the rectal fistula; still these cases are so rare that it is much better to proceed to the radical surgical treatment invariably as soon as the consent of the patient can be obtained.

Operation.—The preparatory treatment should be the same as that described for hæmorrhoid operation. The patient is anæsthetized and the sphincter ani muscles are dilated. Then a grooved director is inserted into the fistula from without and the finger within the rectum feels for a little projection in the form of a granulation, which can be found in quite a large proportion of these cases. By carefully manipulating the grooved director it will find its way along the fistula to a point opposite this granulation, through which it can be pushed into the rectum. Then an incision is made directly through all of the tissues between the grooved director and the rectum. Sharp retractors are placed in the edges of the wound and the granulations are carefully curetted away. If the surgeon looks for prolongations of the fistula, even these, too, in case they exist, end in a little granulation tissue projecting into the sinus which has been curetted. By looking for this little granulation one can feel all the various sinuses, and by laying them open freely and curetting away the granulation tissue one can obtain a perfectly clean wound. If the fistulæ have burrowed through the tissues beyond the sphincter ani muscles in various places the latter should not be severed except at the point of the first incision for fear of having the patient lose control over the action of the bowels and the passage of gas. In case the fistula has existed for a long period of time the cicatricial tissue which has been formed should be dissected away with a sharp scalpel, in order to leave the surface perfectly free from such tissue, and in order to have all portions of the wound in the form of clean-cut surfaces. If all of the infected tissue has been removed, the course to be followed may consist in tamponing the raw surface with iodoform gauze, which is to be left in place for a number of days, and then replaced daily after the evacuation of the bowels, or the surface may be closed by suturing. The latter method should only be chosen in case the surgeon is absolutely certain that all portions of the infected tissue have been thoroughly removed. In that case deep silk-worm gut sutures may be inserted so that they are buried throughout their entire extent, entering the tissues at a point half an inch from the edge of the original wound, passing entirely around the area of the wound and issuing on the opposite side half an inch from the edge of the original incision. The mucous membrane of the rectum may be sutured separately with a row of cat-gut sutures, the silkworm sutures remaining untied in the meantime. If the sphincter ani muscles have been cut a few cat-gut sutures may be passed through these and tied separately. Then the deep silkworm gut sutures are tied over all and a few coaptation stitches are applied to the skin. This method will succeed in healing most of the simple fistulæ within ten days or two weeks; at the end of which time the deep silkworm gut sutures are removed.

After-Treatment.—The after-treatment is the same as after operation for hæmorrhoids. In case, however, the wound has not been closed with sutures an enema should be given after each evacuation of the bowels and then the iodoform gauze tampon should be again applied to the wound, in order to compel the latter to heal from the bottom.

PROLAPSE OF THE RECTUM.

This condition occurs more frequently in childhood than during any other period. It is usually the result of straining on account of constipation or on account of phimosis in young children, or because of the presence of a fissure, giving rise to tenesmus. The mucous membrane of the rectum usually collapses during the evacuation of the bowel and it becomes difficult and painful to replace it.

Treatment.—If one of the causes which have been mentioned still exists, this should be relieved and the condition treated in a non-surgical way at first. The patient should be placed in the inverted position and gentle pressure made upon the prolapsed portion, and a suppository composed of cocoa butter, some mild antiseptic substance, and some astringent substance, should be inserted into the bowel. The lower end of the child's bed should be elevated so as to add the benefit of gravitation to the treatment. If this form of treatment does not succeed in relieving the child, he should be anæsthetized and the sphincter ani muscles very gently dilated, and then the form of treatment with the clamp and cautery, which has been described in connection with the treatment of hæmorrhoids, should be employed, with the exception that only a very small depth of the tissue should be caught by the clamp, and also that the eschar extend a distance of three or four centimeters along the lower end of the bowel. Three, or at least four, longitudinal eschars will almost always suffice to relieve a prolapse in children. Of course, the same care should be exercised to have the eschars extend parallel with the bowel, which has been insisted upon in connection with the clamp and cautery operation for hæmorrhoids.

In the adult prolapse frequently follows the long-continued existence of hæmorrhoids, and usually the relief of the latter will result in the relief of the prolapse. In rare instances it happens, however, that neither of the operations described for the relief of hæmorrhoids could promise any relief in this condition because the entire wall of the intestine may have prolapsed through the anus for a distance of a number of inches. In this case the prolapse should be reduced after the preparations which have been described in connection with hæmorrhoid operations have been carried out. The patient should be placed in bed, with the foot of the bed elevated from six to ten inches. The patient is kept in this position for a variable period, depending upon the severity of the prolapse—from one or two days to as many weeks—in order to disperse the œdema which may exist in the intestine. Then an abdominal section is made through the median line and the lower end of the sigmoid flexure is found and carried to the left side of the abdominal cavity and stitched by means of a considerable number of fine silk sutures directly to the abdominal wall a little in front of the normal location of the sigmoid flexure. In this manner the entire rectum and the lower end of the sigmoid flexure will be carried upwards sufficiently to prevent recurrence of the prolapse. The sphincter ani muscles should be very thoroughly stretched in order to prevent any obstruction to the passage of gas and fæces until the intestine has become firmly united with the parietal peritoneum.

If the sigmoid flexure is drawn upwards, when the abdomen is opened with the patient lying in the Trendelenburg position, the prolapsing peritoneal pouch can be seen and obliterated with interrupted silk sutures, which will give the rectum a very substantial support.

It is important that a non-absorbable suture be used, because if the intestine is sutured in place with ordinary cat-gut the adhesions will be likely to absorb and then the patient will suffer from a recurrence, while if silk or chromicized cat-gut is employed this cannot occur. The patient's bowels should be carefully regulated after this operation, so that there can never be too great an accumulation in the large intestine.

All other causes of intra-abdominal pressure should also be overcome. If there is an obstruction to the passage of urine on account of the presence of a stricture or an enlargement of the prostate gland these conditions should be relieved. If the patient is suffering from a great accumulation of fat in the omentum or mesentery and in the abdominal walls, then by proper diet and exercise this condition should be relieved. If all of these precautions are carried out a recurrence is not likely to take place.

CARCINOMA OF THE RECTUM.

History.—Patients suffering from carcinoma of the rectum usually give a history of long-continued irregularity in the evacuation of the bowels. At first there has usually been long continued constipation; then this has been interrupted by occasional attacks of diarrhœa; then a history of the evacuation of ribbon-like formations of fæces, indicating the presence of some constriction in the rectum, and later on there is usually a history of complete temporary obstruction which may have existed for only a short time at first and may have recurred at various intervals, or the patient may come under the observation of the surgeon during the first one of these attacks of obstruction. In most cases there has been a passage of thick mucus, either with the evacuation of the bowel or during the interval between evacuations. In many cases there has also been a slight amount of hæmorrhage, and very rarely one of these patients suffers from a severe hæmorrhage from the rectum.

Examination.—Upon examination a hard nodular mass is felt in the rectum, usually with a small central opening, or the mass may be upon one side of the rectum and on the other side the mucous membrane may be normal. The sensation to the touch of a carcinoma of the rectum is so characteristic that if a surgeon has once experienced it he will have no difficulty thereafter in recognizing it. It differs from the feeling of a stricture because of the nodular character, and because of the tumor-like projection of the mass, while a cicatricial stricture simply presents the sensation of a narrowing of the canal. It differs from a tubercular stricture from the fact that although the latter also is nodular in character it does not give the impression of a tumor-like projection.

Treatment.—In case the carcinoma is in the lowest portion of the rectum and does not extend above the cul-de-sac of Douglas, and is movable, the treatment should consist in the excision of the entire mass, together with the surrounding tissues to as great an extent as is possible. The incision through the skin should be free, it should pass up behind to the lower edge of the sacrum, it should include the coccyx, and the entire mass should be loosened from its attachment in one piece, so as to avoid the implantation of carcinomatous tissue during the operation. The rectum should be freed for a distance of at least two inches beyond the upper margin of the carcinoma, two pairs of strong forceps should be applied to the bowel at this point; and the latter should be severed between these forceps and the tumor thus removed. The bleeding vessels should be caught during the operation, so that the loss of blood will be reduced to a minimum, and from time to time all of these vessels which have been caught should be ligated so as to leave the field of operation as free from obstruction, on account of the presence of hæmostatic forceps, as possible. The upper segment of the intestine should then be freed sufficiently so that it can be brought into the upper angle of the wound and carefully sutured to the skin.

Personally, I have never encountered a carcinoma of the rectum in which it seemed safe to preserve the sphincter ani muscles. In a few cases in which I have attempted to remove the malignant growth and to attach the upper segment of the intestine to the lower segment, and thus preserve the sphincter ani muscles, there has been a recurrence, but in the vast majority of cases the fact that a recurrence would occur was so plain at the time of the operation that the preservation of the sphincter ani muscles was not undertaken.

In case carcinoma of the rectum is so far advanced that a rapid recurrence would be inevitable in case of its excision, a condition which can usually be predicted when the tumor is removed, then I believe it is much wiser simply to perform an inguinal colostomy, which has already been described in connection with the chapter on abdominal surgery.

In case the carcinoma is in the upper portion of the rectum, or in the lower portion of the sigmoid flexure, then the operation which has been described in the chapter on abdominal surgery should be performed. In the female it often occurs that the carcinoma is upon the anterior surface of the rectal wall and has attacked the recto-vaginal septum; in this case the posterior vaginal wall should be removed, together with the entire rectum, after the method which has just been described.

After-Treatment.—The after-treatment in these cases is the same as in operations for hæmorrhoids, with the exception that the wound should be dressed daily in order to prevent its infection.

Prognosis.—In cases in which the carcinoma has not perforated any portion of the intestine, the prognosis is relatively good, provided the amount of tissue removed is quite as extensive as though the case were advanced in its development. In advanced cases the prognosis is not good, without regard to the operation which has been chosen. In my own experience the cases in which permanent inguinal colostomy was made prior to the excision of the carcinoma have lived longer than those in which the fæces were permitted to pass through the rectum after the excision of the growth.

Surgery of the Female Genital Tract.

During the past few years there has been much difference of opinion regarding the advisability of treating the various surgical diseases of the pelvic cavity through an abdominal incision, or through a vaginal incision; the general surgeon, as a rule, being more familiar with the abdominal route than with the vaginal, has usually supported the former operation, while the gynæcological specialist has more commonly advised the vaginal route for the relief of all conditions in which this could be accomplished through a vaginal incision. The abdominal route has undoubtedly the advantage of enabling the surgeon to expose the pelvic cavity freely, especially since these operations are performed with the patient in the Trendelenburg position, by means of which the intestines can easily be removed from the pelvis, leaving only the uterus and adnexæ, the bladder and the rectum in this cavity. This route also enables the surgeon to examine the appendix, for disease frequently the concomitant of other pelvic troubles; it also enables him to examine the gall bladder and to dispose of adhesions between the omentum or the intestines and the pelvic organs. The vaginal route has the advantage of being safer in the hands of a surgeon who is familiar with this class of operations, the mortality in all forms of operation performed by this route being exceedingly low.

VAGINAL HYSTERECTOMY.

This operation is indicated in the presence of carcinoma of the uterus so long as this organ is movable and so long as there is no positive evidence of the invasion of any of the surrounding tissues and no infection of the inguinal lymphatic glands. In case the organ is no longer movable the patient has lived longer and more comfortably, in my experience, if instead of removing the uterus I have protected the vaginal walls and have thoroughly cauterized the entire uterine cavity by introducing cautery irons heated to red heat. The most convenient form of cautery iron for this purpose, according to my observation, is the ordinary soldering iron heated in a tinner's heater or in a coal fire or in the flame of a gas stove. A number of these irons are placed in the flame and are introduced into the cavity of the uterus successively until the entire cavity has become lined with an eschar. An iodoform gauze pad covered with glycerine is then inserted and a retention catheter is introduced into the bladder. After the eschar becomes separated the connective tissue which forms during the process of healing contracts the organ and is likely to retard the progress of the disease. Many of these patients improve so much that the surgeon is likely to doubt his diagnosis, and in one instance at least one of my cases, which seemed entirely inoperable and hopeless, lived for a period of thirteen years and died of an intercurrent disease without having had a recurrence of the carcinoma. A number of other cases have lived for several years. Of course, this is not the rule. Most of these patients have a recurrence within one or two years, to which they succumb.

The most important point regarding the treatment of carcinoma of the uterus, however, is the early diagnosis and the immediate treatment. In order to make an early diagnosis I believe it is important that the surgeon should make a careful examination in every case in which there is the slightest suspicion of the presence of malignancy. This is true especially at about the period of the menopause or after the end of this period. In almost every case which has come under my care for treatment, there has been a history of uterine hæmorrhages more or less extensive. If these hæmorrhages occur in a patient fifty years of age or over the physician should recognize the gravity of this symptom. If he temporizes with the case without having satisfied himself positively regarding the diagnosis, the chances are that by the time the diagnosis is made the case has passed beyond the stage at which surgical intervention could result in permanent benefit.

If the growth begins in the cervical portion of the uterus, which is its most common origin, then it can be at once discovered upon

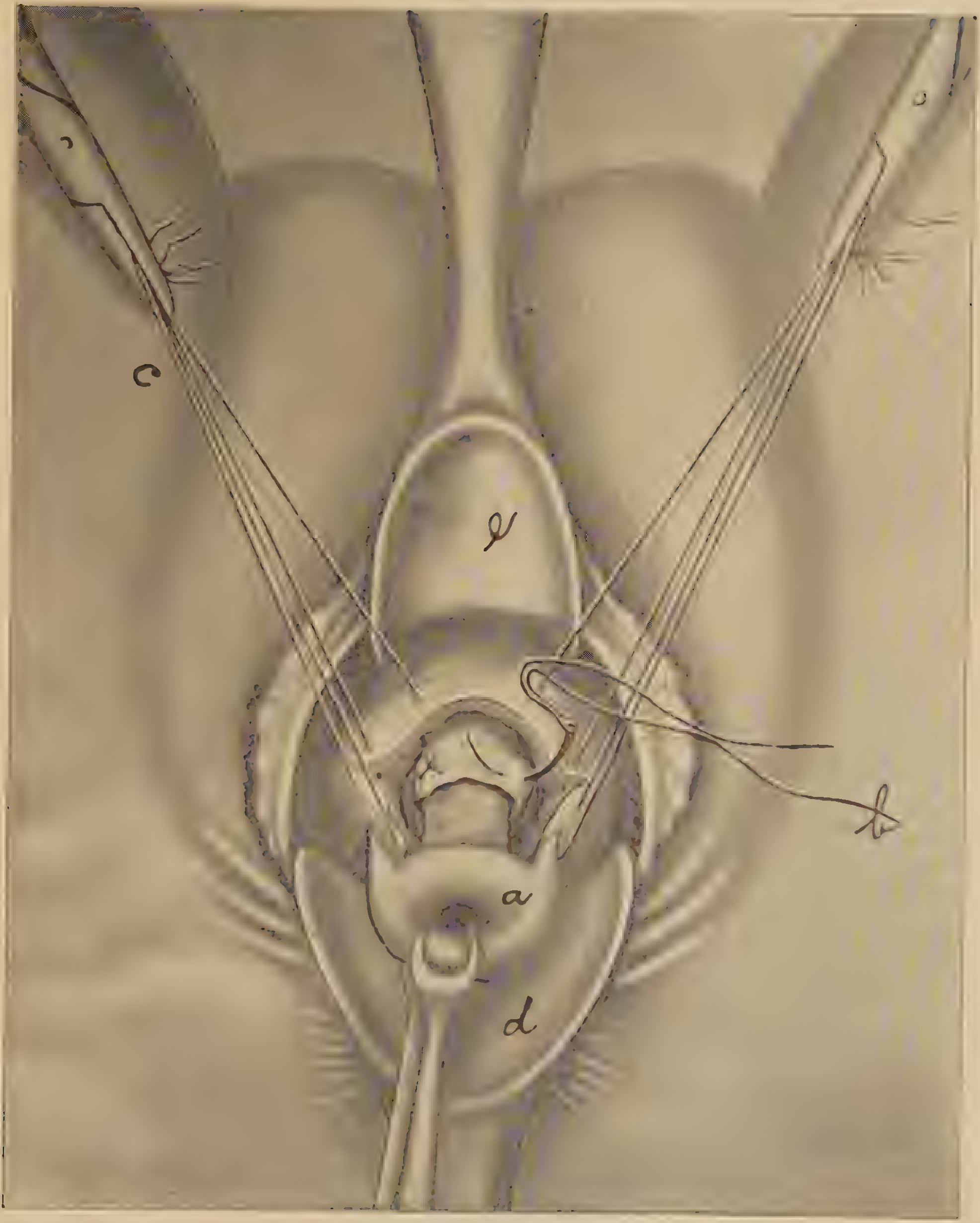


PLATE LXV.
VAGINAL HYSTERECTOMY.

The vaginal orifice is held open by means of specula (e) (d). The cervix (a) is loosened from its vaginal attachment by an elliptical incision. The uterine arteries are picked up with a cat-gut suture (b) and tied. Sutures are inserted on either side (c) for the closure of the wound, but left untied until the uterus has been removed.

making a digital examination or an examination with the speculum. In case the tissues appear suspicious, with this history and at this age, I believe that a hysterectomy should be performed at once. In many cases in which portions of the malignant growth have been removed for microscopical examination my experience has been that this simple procedure has resulted in the stimulation of the growth to such an extent that even in very recent examples there has been no permanent cure after this method of diagnosis has been employed. I believe that the removal of portions of tissue for microscopical examination prior to operation should be most strongly condemned. The same is true if hæmorrhages occur in patients after the menopause in whom neither cervical carcinoma nor fibroid of the uterus can be diagnosed by physical examination. In these cases it has been the practice to make a curettement of the lining of the uterine cavity and make a microscopical examination of the portions which have been curetted away. Here, again, the danger of infection with carcinoma is so great that I believe the practice should be absolutely abandoned.

OPERATION.—The danger of infection with carcinoma during the operation should be thoroughly borne in mind, because it is not necessary during the operation to wound any portion which has been infected. If the mass projecting from the cervix has a cauliflower appearance this should be removed by means of a cautery before the operation is begun, because in such way all of the surfaces through which the incision is to be made are destroyed by the heat, and consequently an infection from them is not possible. After the cervix has been cleansed by means of the cautery, if the carcinoma be cervical in character, a pair of volsellum forceps may be inserted a sufficient distance away from the carcinomatous tissues to insure the fact that they do not cause implantation into the latter. The vaginal mucous membrane is then severed circularly around the entire cervix at a distance of at least two centimeters from the margin of the diseased tissue by means of a Paquelin cautery or an electric cautery. I believe that some of the recurrences in my cases have been due to a neglect of this plan of operation.

The uterus is then drawn downward and the dissection is carried on in front and behind by means of the cautery until the peritoneal layer is approached, care being taken throughout this part of the operation to avoid injuring the bladder in front and the rectum behind. The location of the bladder can be determined by inserting a steel sound through the urethra occasionally throughout the progress of the operation. After the dissection has been carried to this point by means of the cautery, the peritoneal cavity is opened anteriorly by means of blunt dissection with the finger, and then it is opened posteriorly in the same manner and a piece of sterilized gauze is carried behind the cervix into the cul-de-sac of Douglas in order to prevent the soiling of the latter cavity from the cervix. The fundus of the uterus is then brought to the anterior opening in the peritoneal cavity or through the posterior opening, according to the direction in which this can be accomplished most easily. If the fundus is brought down posteriorly, then a piece of sterile gauze should be inserted anteriorly to protect the peritoneal cavity against soiling.

The maner in which the uterus can be brought down most conveniently is by means of the cat's-paw retractors, as indicated in Plate LXV. The ovary and tube on one side are then brought forward into the wound by means of forceps placed upon the broad ligament or by digital manipulation. Then a pair of heavy, long-jawed compression forceps is applied to the broad ligament beyond the ovary and tube from above downwards, in order to avoid the ureters. These forceps should be so constructed that it is impossible for the tissue to slip from the end of them or out of their grasp. The broad ligament is then cut along these forceps and a second pair of forceps of the same kind is applied to the remaining portion of the lateral pedicle containing the remainder of the broad ligament, together with the uterine artery. The remainder of the pedicle is then severed and the uterus is attached now only upon one side. It is then an easy matter to bring out the other ovary and tube and to clamp the pedicle beyond these in the manner which has just been described. The uterus is then entirely cut away. A strand of iodoform gauze is placed over the ends of these forceps in order to prevent them from doing injury by coming in contact with the intestines in the peritoneal cavity, and then the points of the forceps are shoved beyond the vaginal wound. A further

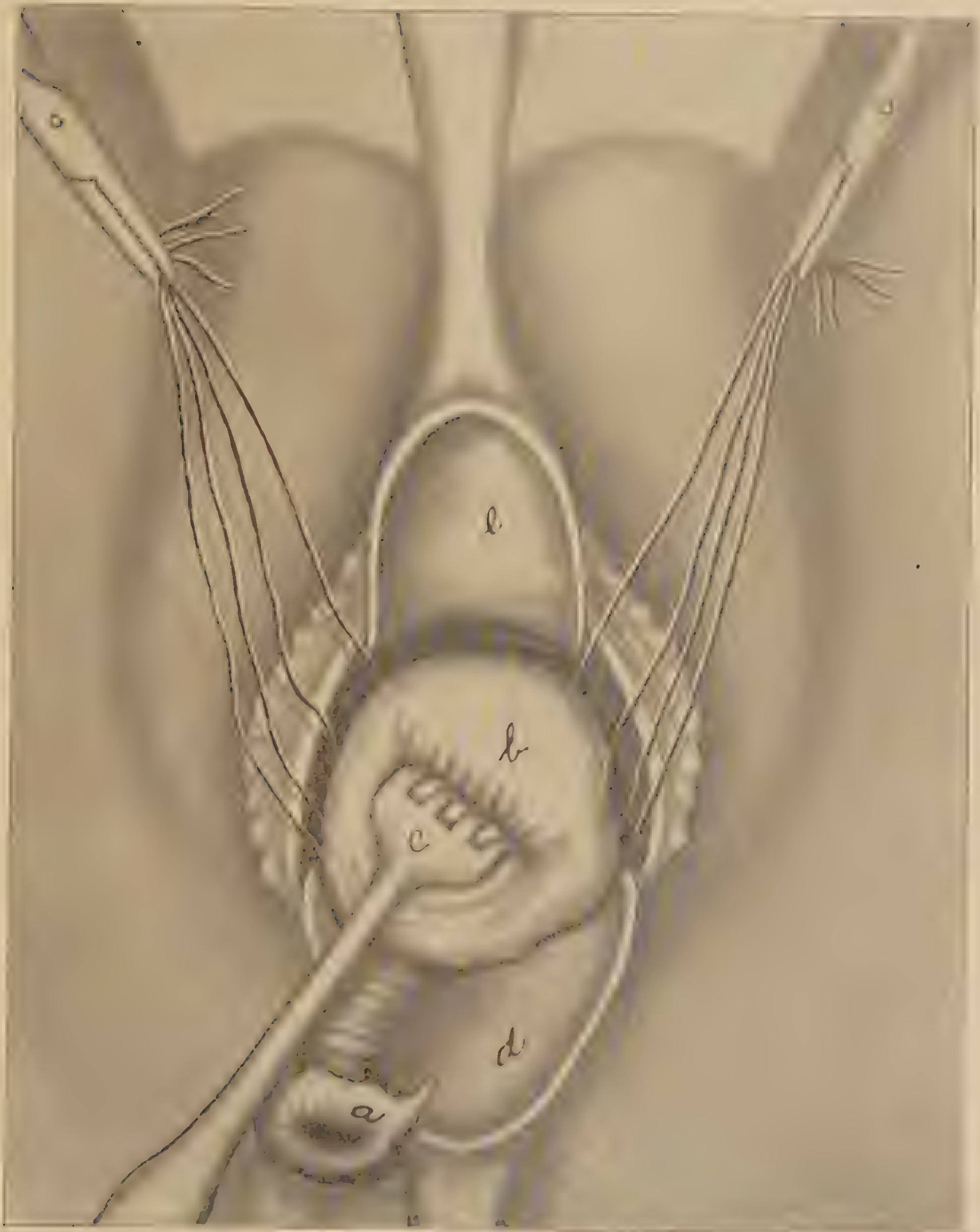


PLATE LXVI.

VAGINAL HYSTERECTOMY.

The orifice is held open as in the previous plate. The peritoneal cavity has been opened in front and behind the cervix and the uterus has been brought down and inverted by means of traction with the cat's-paw retractor (c).

tampon is placed in the opening in the vagina and the outlet of the vagina is tamponed with a piece of iodoform gauze, thoroughly saturated with vaseline, in order to prevent the soiling of the deeper tampons from without. The introduction of a retention catheter and the application of the external dressing completes the operation.

I believe that if the carcinoma has invaded any portion which cannot be reached by this operation the patient is primarily in a hopeless state. In all cases of carcinoma beginning in the cervix, in my experience, in which there has been a recurrence, this recurrence has always taken place in the vaginal mucous membrane, and in the scar tissue resulting from the operation in the apex of the vagina and never elsewhere; consequently the more complicated and more dangerous combined operation through the vagina and through an abdominal incision does not seem indicated in cases of carcinoma originating in the cervix. In case the carcinoma begins in the mucous membrane lining the uterus then the invasion may occur through the lymphatics accompanying the round ligaments into the inguinal canals, and in that case it may be advisable to make use of the combined method.

It has seemed to me that there exists a distinct advantage in using the clamps for the purpose of hæmostasis in these cases in preference to the use of a ligature, because the line of incision through the pedicle, which might be a favorable field for infection with carcinoma, is thus eliminated on account of the sloughing which takes place in the portion contained in the bite of the forceps.

After-Treatment.—The forceps are left unmolested for twenty-four or thirty-six hours, when they are loosened and left in place so that the portion contained in the bite of the forceps may spontaneously retract from the latter. Several hours later the forceps can be withdrawn without giving the slightest amount of pain to the patient, while if they are withdrawn at once upon being loosened the act is usually accompanied with a considerable amount of pain and occasionally hæmorrhage. The most superficial tampon is removed at the time of removing the forceps and fresh vaseline is applied to the parts. The deeper tampons are removed from the fifth to the eighth day, as they become loosened. About the tenth day the speculum is introduced and the sloughs which have become loosened by this time are removed by means of dressing forceps. After the last piece of gauze has been removed the patient is given warm douches of some mild antiseptic character from three to six times a day, care being taken to have the fountain syringe very slightly elevated, so that it is not possible for the stream to injure the adhesions which have formed in the upper portion of the wound. These douches are a source of comfort to the patient and are perfectly harmless if given in this manner. The retention catheter is left in place until all of the gauze tampons have been removed, unless it gives rise to discomfort, in which case it may be removed sooner and the urine may be withdrawn by means of catheterization. If the catheter is left in place too long it may become filled with phosphatic concretions, unless a few drops of a dilute mineral acid be given in a considerable quantity of water three to six times daily.

A very comfortable external dressing consists of pads saturated with one part of alcohol and two parts of hot water, and covered with a large piece of dry cotton held in place by means of a T-bandage. Aside from this the after-treatment is the same as after any ordinary abdominal section.

Prognosis.—The prognosis depends upon the extent of the invasion of the tissues by the disease. If the operation is performed early and the cautery is used in severing the tissues, and the remaining steps are followed, as has been indicated, the prognosis is fairly good. In advanced cases of carcinoma the prognosis is bad.

VAGINAL HYSTERECTOMY FOR NON-MALIGNANT CONDITIONS.

In case of severe uterine hæmorrhage, due to the presence of small uterine fibroids, which cannot be controlled by means of simpler methods, a vaginal hysterectomy is indicated because of its easy execution and because of the fact that it does not give rise to a scar and is as safe as the abdominal method. In this case it is not necessary to make the vaginal incision by means of the cautery. The remaining steps of the operation are the same as in vaginal hysterectomy for carcinoma, but there is no necessity for leaving the pressure forceps in place, and the patient's comfort

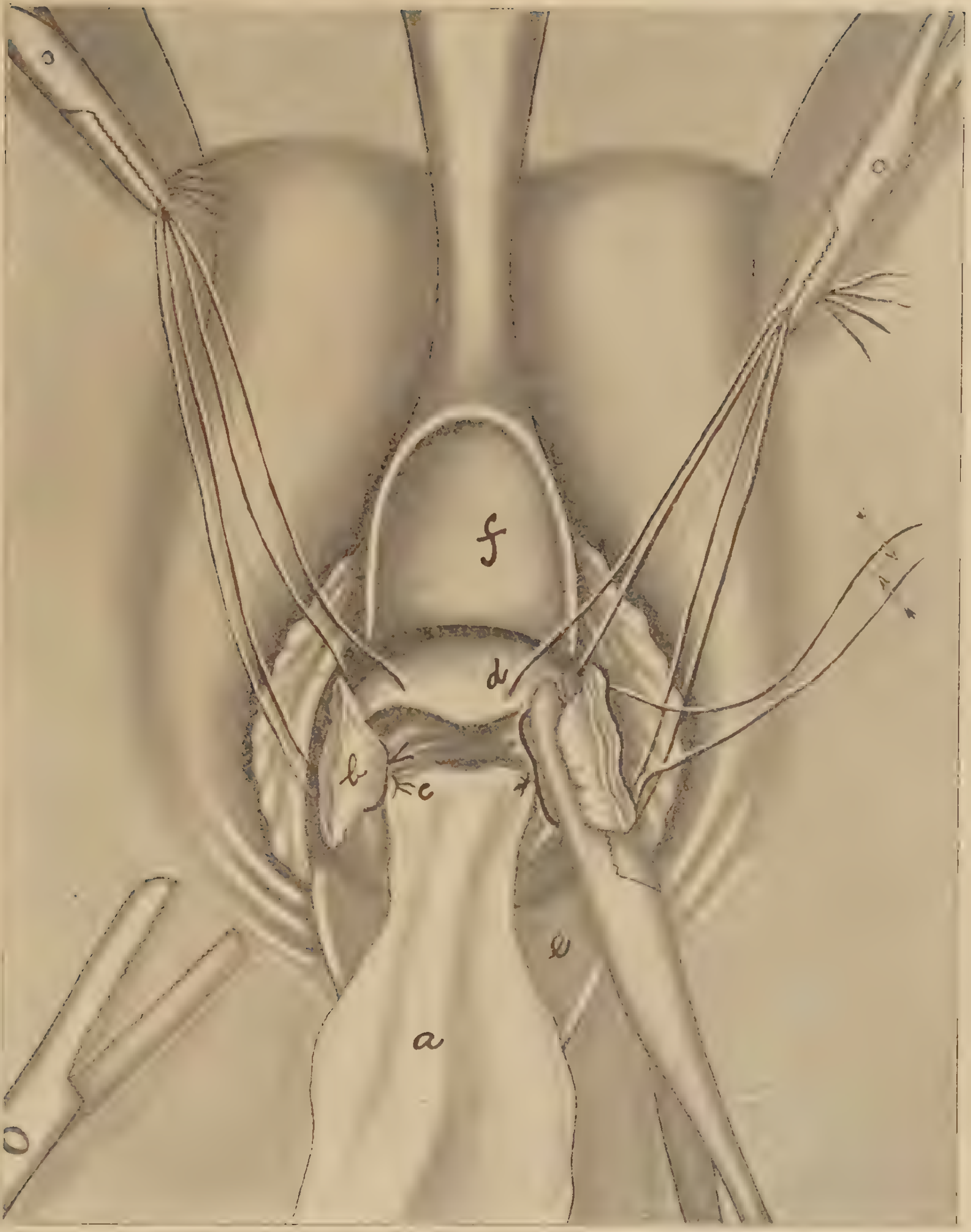


PLATE LXVII.
VAGINAL HYSTERECTOMY.

The uterus has been removed; the left broad ligament is still held with clamp forceps, the ligature being in place, but not tied. The clamp forceps have been removed from the right broad ligament (b) and the ligature has been tied. A piece of iodoform gauze has been sutured to the stumps of the broad ligaments with two cat-gut sutures (c).

is increased by applying a ligature around the portion of the pedicle containing the uterine artery, as indicated in Plate LXVI, and a second ligature around the remaining portion of the pedicle, as indicated in Plate LXVII, so that two ligatures will take the place of the two pressure forceps in the operation which has just been described. The ligatures should be passed through the pedicle in a manner which will prevent their slipping, because a careless application of ligatures at this point might result in a dangerous hæmorrhage. Two cat-gut stitches are inserted through the edge of the wound to one side of the center and left untied, as indicated in Plate LXVI, until the tampon of iodoform gauze has been fastened to each of the two lateral pedicles by means of a small cat-gut stitch, as shown in Plate LXVII. The tampon should then be shoved up into the abdominal cavity, together with the two lateral pedicles, and then the stitches in the wound are tied, as illustrated in Plate LXVIII. This provides for the approximation of the two lateral pedicles and for the closure of the vaginal wound, and also for a sufficient amount of capillary drainage. The approximation of the lateral pedicles is especially valuable in case the operation is performed for the relief of complete prolapsus of the uterus, because in this manner a support for the floor of the pelvis is provided. A retention catheter is inserted as before and the after-treatment is carried out in the same manner, the iodoform gauze tampon being removed between the fifth and tenth day after the operation.

PROLAPSE OF THE UTERUS.

In case of prolapsus of the uterus in patients advanced in years in which the tissues of the broad ligament seem to be fairly substantial, the operation which has just been described has given most satisfactory results. In case, however, the entire vaginal mucous membrane, together with the posterior wall of the bladder and the anterior wall of the rectum, show a tendency to prolapse, these latter structures are likely to continue to descend after the operation which has just been described has been performed, and in such cases the patients will be but slightly improved unless a more extensive operation is chosen.

The operation which seems to invariably give relief in these cases consists in the additional removal of the entire vaginal mucous membrane and the closure of the entire canal by means of buried cat-gut sutures. The operation which has just been described is performed, with the exception that the two lateral pedicles are united to each other by means of buried cat-gut sutures, and then the entire mucous lining of the vagina is dissected out from above downward, leaving a raw canal throughout. This is closed by a series of buried cat-gut sutures from above downward, and at last the skin at the entrance of the vagina is united by means of a longitudinal suture extending from a point two centimeters above the meatus urinarius down to the anterior edge of the perineum. In applying the buried cat-gut sutures it is important that neither the rectum nor the bladder be wounded, for fear of producing a recto-vesical fistula.

After-Treatmet.—The after-treatment is the same as after an ordinary abdominal section.

Prognosis.—The prognosis in this operation is very favorable. In case of prolapsus of the uterus in younger patients it is usually found that the displacement is due to an abnormal elongation of the cervix. There seems to be a tendency on part of the tissues of the vagina to make traction upon the elongated cervix and thus cause a prolapsus of the uterus. The replacement of the latter is of no apparent benefit to the patient, and the support by means of pessaries seems to be of no avail. If, however, the following operation be employed for the purpose of removing the elongated cervix the broad ligaments seem to be able to support the uterus in its normal position, and the organ will remain in its proper position without any further support.

Operation.—A circular incision is made about the end of the elongated cervix and the mucous membrane surrounding the latter is reflected to a point a little below the upper extremity thereof. This point may be at a considerable distance from the lower end of the cervix, as shown in Plate LXIX, which was drawn from nature, and in which the cervix had reached the length of twelve centimeters. Upon a casual examination it seemed as though there were

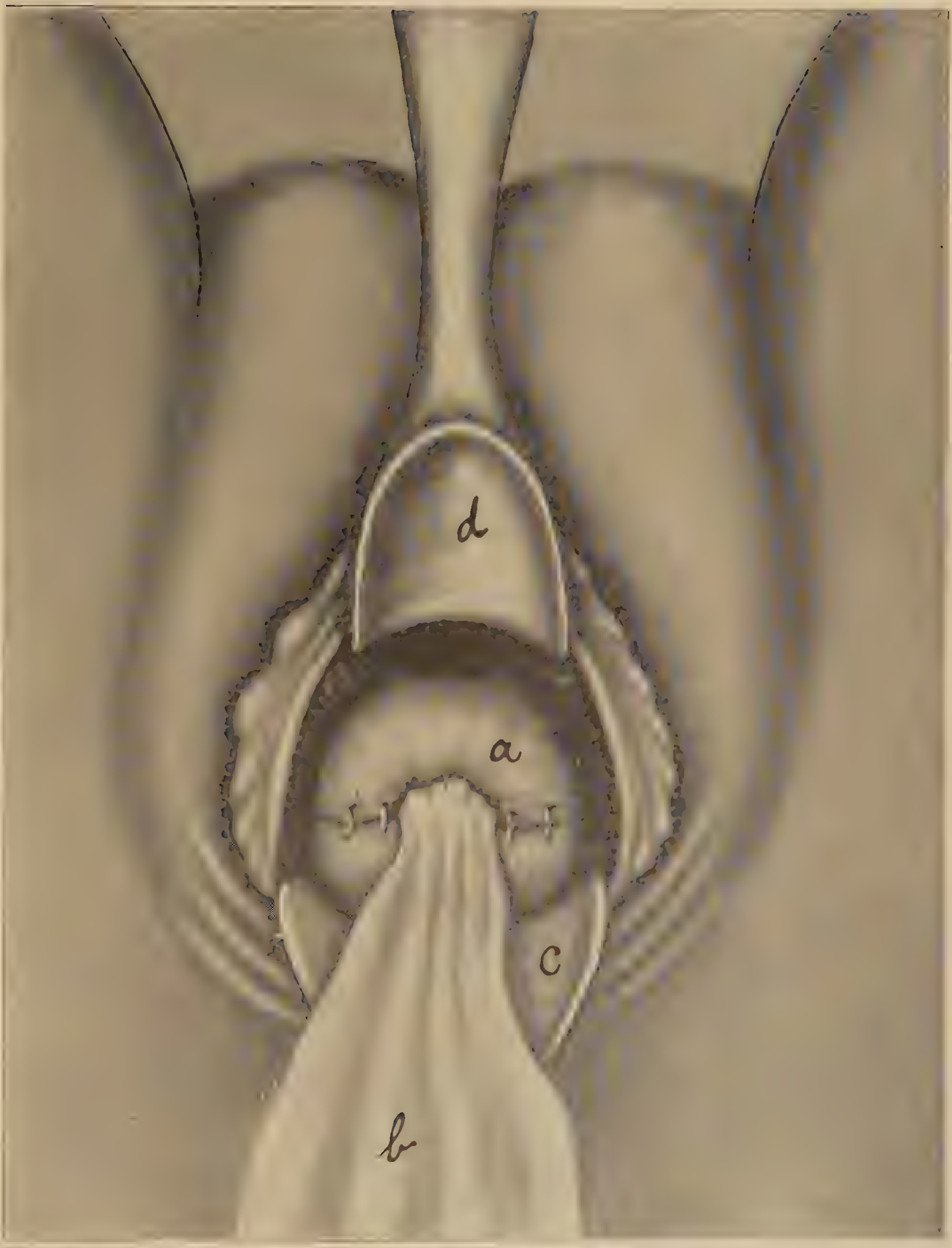


PLATE LXVIII
VAGINAL HYSTERECTOMY.
The operation completed. The orifice held open by the specula (c) and (d). The vaginal vault (a) closed by tying the sutures. The iodoform gauze drain (b) in place.

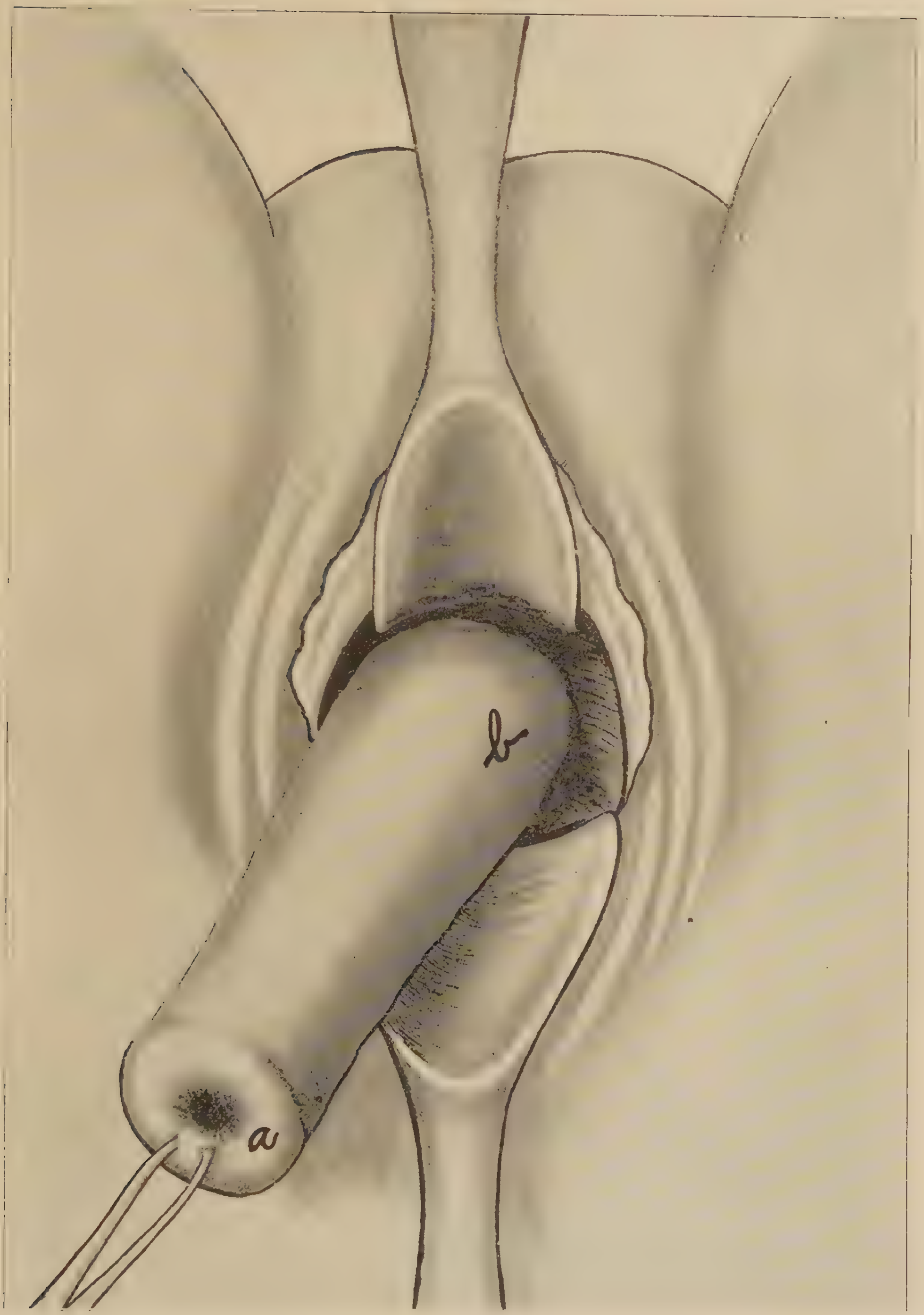


PLATE LXIX.
Excision of Elongated Cervix Uteri.
The elongated cervix (a) (b) withdrawn from the vaginal orifice.

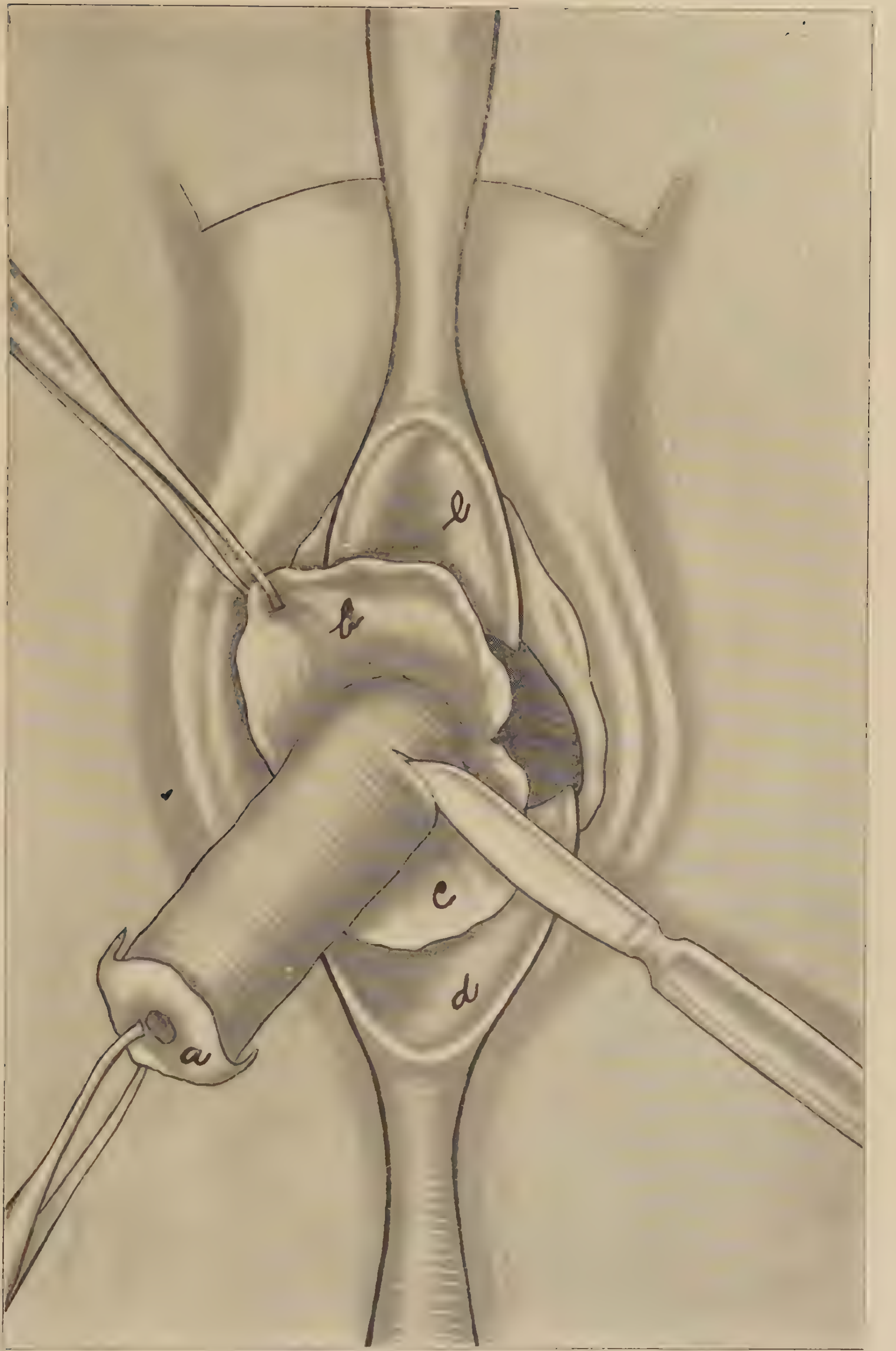


PLATE LXX.
Excision of Elongated Cervix Uteri.

The mucous membrane covering the cervix has been reflected by making an elliptical incision around the cervix (a). Thus an anterior (b) and a posterior (c) mucous flap are formed and the projecting cervix is amputated.

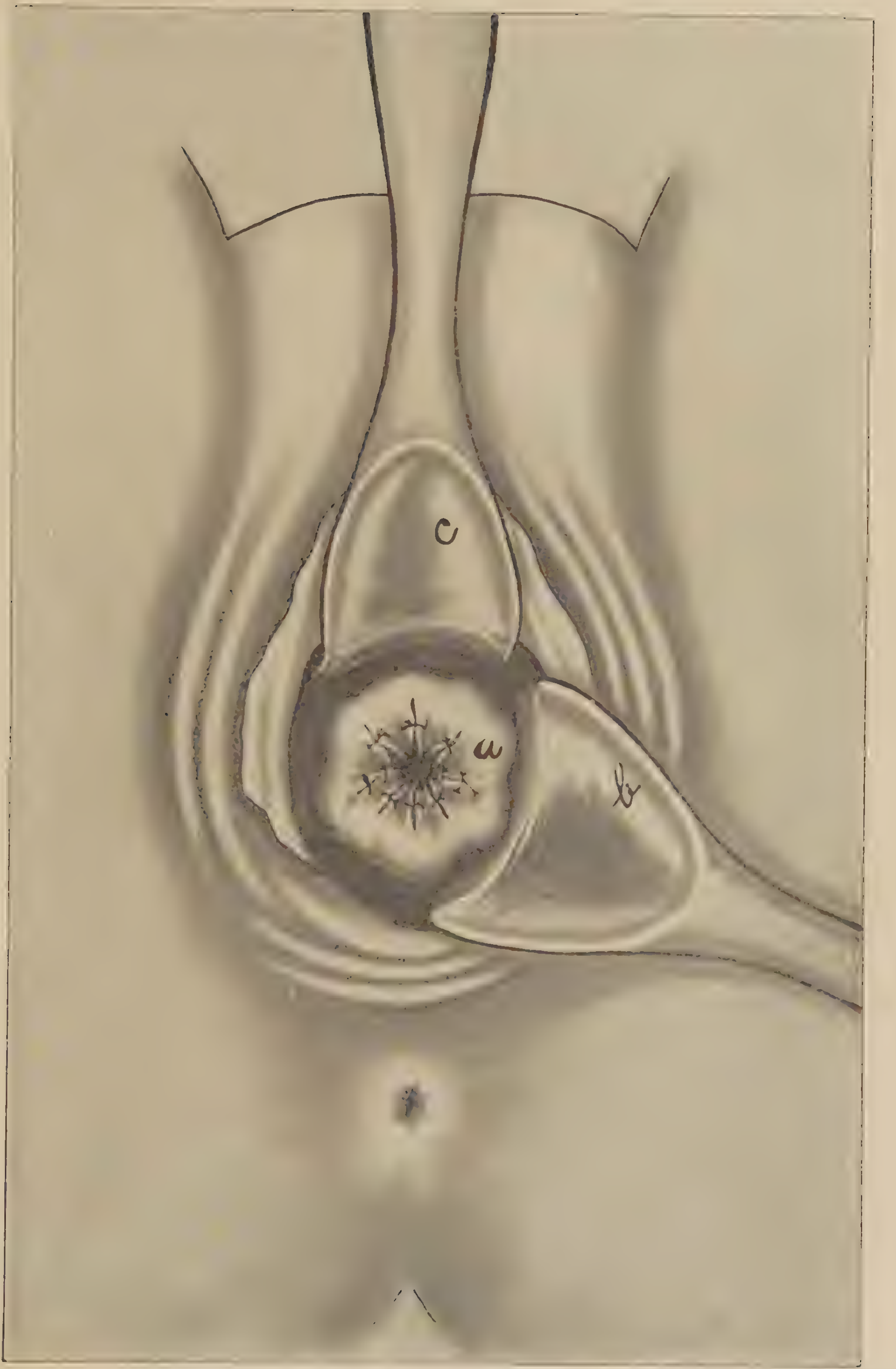


PLATE LXXI

CLOSURE OF WOUND IN CERVIX.

The flaps of mucous membrane are brought down over the stump, sutured to the mucous membrane lining the uterine cavity, and all raw surfaces are covered with portions of the mucous membrane, making a perfectly uniform stump (a).

a prolapse of the entire uterus, but upon careful inspection it was found that only the elongated cervix projected. The mucous membrane was carefully dissected upwards in the anterior and posterior flap, as indicated in Plate LXX, and severed just below the upper extremity of the cervical canal. As soon as this portion of the cervix had been cut away the uterus showed a tendency to slip up into the pelvic cavity and had to be held down in position in order to complete the operation, which consisted in covering the stump with the mucous membrane removed from the portion of the cervix which had been cut away, as shown in Plate LXXI. This method insures the formation of a normal cervix.

As has been stated before, the uterus showed a tendency to slip up into the pelvis and take up a normal position as soon as it was released from below, even in this greatly exaggerated case. This, however, is not the history in patients advanced in years who have given birth to a number of children. In these patients the hysterectomy which has just been described is to be preferred.

EROSION OF THE CERVIX.

In many patients, but especially in those whose occupation compels them to stand a greater part of the day, the pressure of the cervix upon the tissues upon which it rests results in a condition of erosion, which in turn results in the formation of exceedingly hard cicatricial tissue. This condition is most common in women who have borne children, because in these the uterus has usually not undergone complete involution, and the consequent increase in weight increases the pressure and consequently favors the result in question.

The pressure resulting from the contraction of the cicatricial tissue is likely to produce the symptoms described in connection with laceration of the cervix, and the same treatment is indicated.

LACERATION OF THE CERVIX.

In a considerable proportion of patients going through childbirth the cervix of the uterus is lacerated. In case the wound is not kept aseptic the healing is bound to be slow, and there must result a variable amount of connective tissue. In case of a second delivery the tissues are less elastic than normally, because of the presence of this cicatricial tissue, and consequently a further laceration is almost certain to occur, and this is apt to be more extensive than the previous one. In cases in which the patient can obtain reasonable care during the pregnancy, and during and after confinement, the wound usually heals so perfectly that it requires no further attention, but unfortunately there is a large class of women, and this class comprises the most valuable women in the country, in which conditions are such that ideal care during pregnancy and during the after-confinement, is not possible. This class comprises the wives of the mechanics, artisans, farmers and laborers of this country.

History.—The patient usually gives a history of having been in excellent health at the time of her marriage, of having undergone a variable number of normal pregnancies and usually a certain number of abortions, the confinement has generally been conducted by a midwife, the patient has felt the necessity of caring for her entire household during her pregnancy, she has had but a slight amount of care during and after her confinement, she has not enjoyed the benefits of a trained nurse at this time, she began to perform her regular labors within a short period after her confinements, and has had the care of her infant and all of her family within a short time after this. Usually the first few confinements made no marked impression, but later on the patient began suddenly to grow old apparently rapidly, to suffer from the sensation of weight in the pelvis, and from pain low down in the back, and she usually complains of having felt tired most of the time. Constipation and lack of strength in securing evacuation of the bowels are usually complained of. Notwithstanding this, the patient frequently has gained in weight, her abdominal walls have become greatly thickened with the accumulation of this fat, but the normal tone of the abdominal walls has been lost. Later on the patient has complained of nervousness, has become irritable, her digestion has become impaired, and this condition frequently continues until she is nearly, if not wholly, bed-ridden.

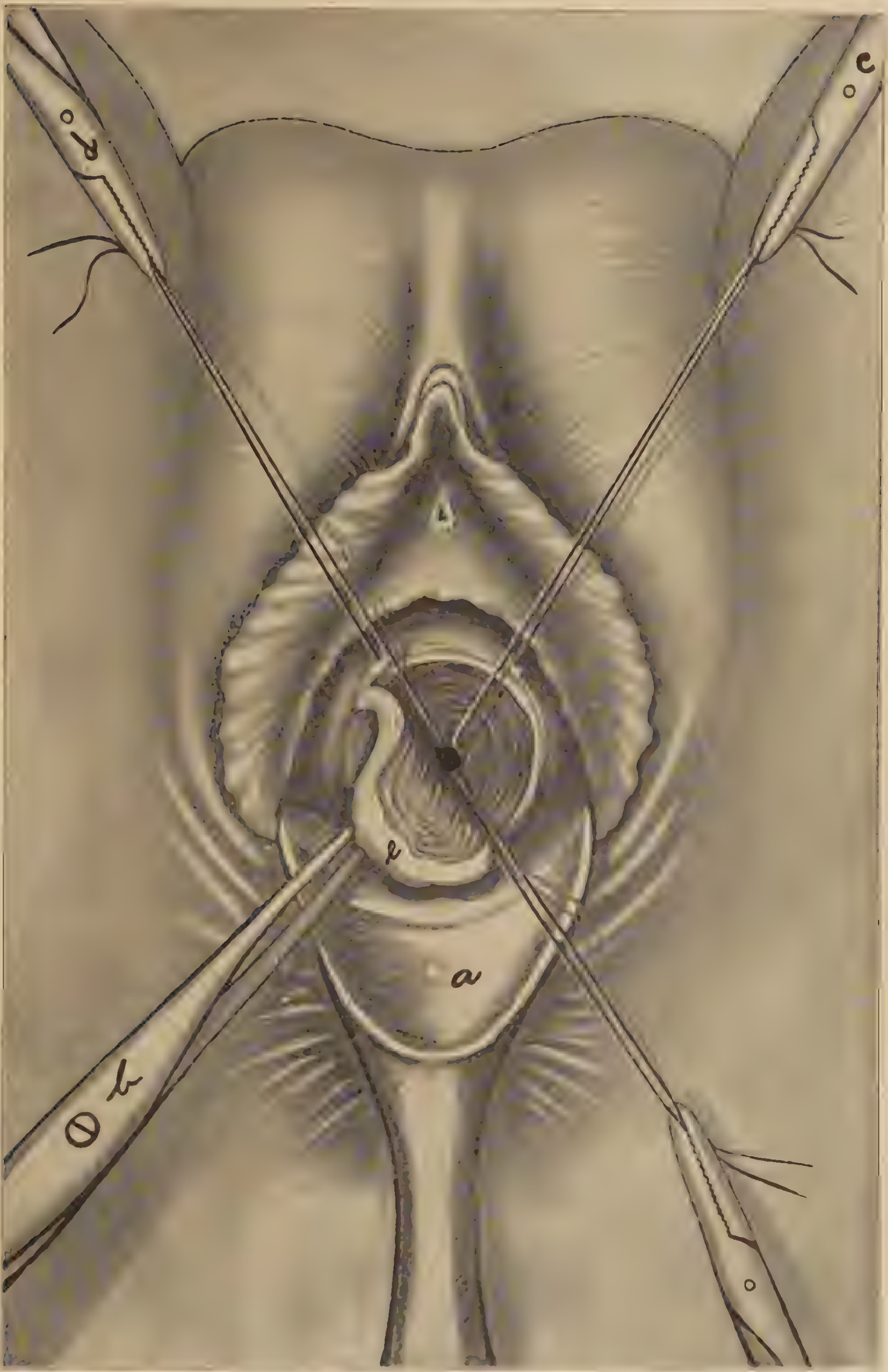


PLATE LXXII.

Amputation of Lacerated Cervix Uteri.

The uterus is drawn down with volsellum forceps (b). An elliptical incision is made around the cervix. The anterior portion (e) is dissected down to the cervical canal. Then sutures (c) and (d) are inserted, uniting the vaginal with the cervical mucous membrane. These are left untied until the lateral sutures have been applied. Then the removal of the cervix is completed.

Upon examination the perineal support of the uterus is found to be greatly impaired, the vaginal walls are loose and flabby, the cervix is greatly thickened and œdematous, and in a majority of patients there is a laceration of the left side. Occasionally there are several other lacerations of the cervix, all filled with hard cicatricial tissue, and the uterus is found upon bi-manual examination to be considerably hypertrophied, sometimes two or three times the normal size—involution not having taken place after the confinements and abortions. The fundus of the uterus may be retroverted or it may be in a nearly normal position. The entire organ is likely to be somewhat prolapsed and somewhat displaced backward.

Preparatory Treatment.—The preparatory treatment in these cases should be the same as for any ordinary operation, unless the cervix is covered by a septic ulcer. In such instance, it is wise to place the patient in bed for a few days before the operation is performed, to give her large, very hot douches from three to six times a day, and at night to apply some antiseptic, such as compound tincture of iodine, equal parts of compound tincture of iodine, glycerine and carbolic acid, or a tampon of twenty-five per cent. ichthyol in glycerine. During this period of treatment the patient should also receive mild laxatives and light diet.

Treatment.—The treatment which I have found most valuable in these cases consists in the removal of all of the hardened tissue in the cervix and then covering the abraded surface with vaginal mucous membrane. A broad vaginal speculum is introduced, as shown in Plate LXXII, and a volsellum forceps is applied to the posterior lip of the cervix. With this it is drawn downward and a little forward, and an elliptical incision, including all the hardened tissue in the cervix, is made by means of a sharp scalpel. The posterior lip is not entirely severed during this stage, but the anterior lip is severed down to the cervical canal. Then two chromicized cat-gut stitches are applied to the anterior lip in the following manner:

One-eighth of an inch of vaginal mucous membrane is grasped with a short-curved needle, as shown at c and d, Plate LXXII. The needle at the same time grasps about one-third of the thickness of the underlying muscle; then it is reintroduced into the cervical tissue and the same amount of tissue, including the mucous membrane lining the cervix, is grasped with these sutures. These sutures are then left untied until the remaining portion of the operation has been completed, and then their tying will approximate perfectly the vaginal mucous membrane and the mucous membrane lining the cervical canal. Now, these two sutures will serve to manipulate the uterus during the remaining portion of the operation. The hardened tissue is now completely cut away, leaving the cervix as shown in Plate LXXIII—two further sutures inserted posteriorly, corresponding to those which were applied anteriorly before the cervix was entirely cut away. These are also left untied. Two further sutures are then applied on each side, grasping the mucous membrane in front; then to the substance of the cervix to each side of the cervical canal; then to the mucous membrane behind. After all of these sutures have been applied they are tied successively, the outer ones being tied first; the two sutures grasping both the vaginal and the cervical mucous membranes being left to the last. After all of these have been tied the entire abraded surface will be covered, with the addition of a few coaptation sutures, as indicated in Plate LXXIV.

This leaves the cervix in as nearly an ideal condition as possible, and in case of a future pregnancy the cervix is not any more likely to become lacerated than it would be had it never had a laceration nor an operation. In quite a considerable number of patients I have had an opportunity to observe the outcome after a future confinement, and in all of these the condition has been most satisfactory.

The chromicized cat-gut to be used should be prepared so that it will absorb within about two weeks. This will dispose of the annoyance of removing the stitches after the operation. It is important in this operation that the stitches should not be drawn too tightly, because a certain amount of œdema is sure to occur, and this is greatly increased in case the stitches are tied tightly. In this event each stitch will leave a line of pressure necrosis across the surface, and this will again be occupied by hard nodular tissue. The removal of the hard connective tissue in these cases is the most important benefit that the patient derives, and consequently nothing

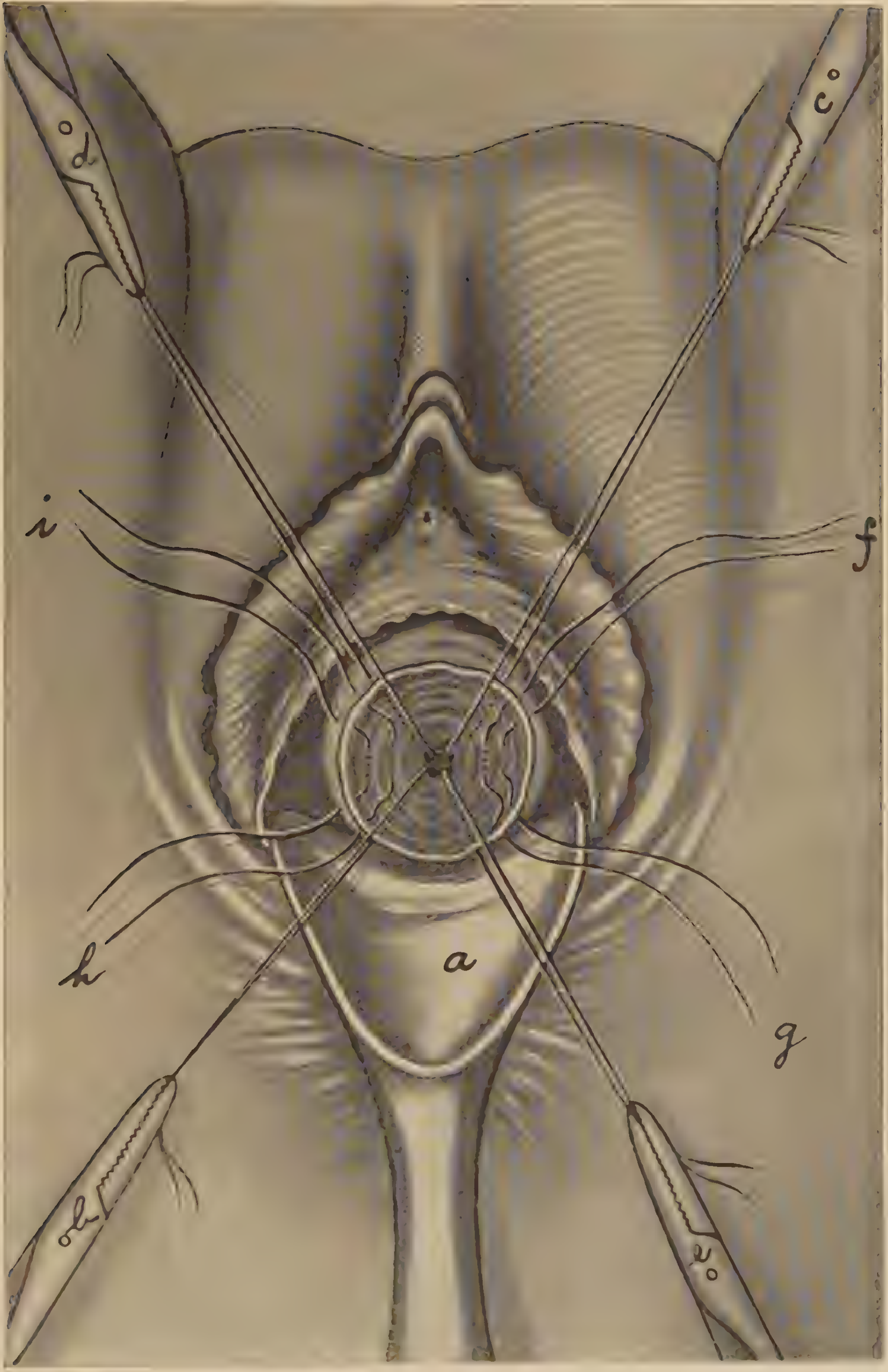


PLATE LXXIII

AMPUTATION OF CERVIX UTERI FOR LACERATION.

(b), (c), (d) and (e) represent the sutures which unite the mucous membrane of the vagina with that of the cervical canal, preventing closure of the latter; (f) (g) and (h) (i) represent the sutures on either side which cover the raw surface resulting from the excision of the cervix.

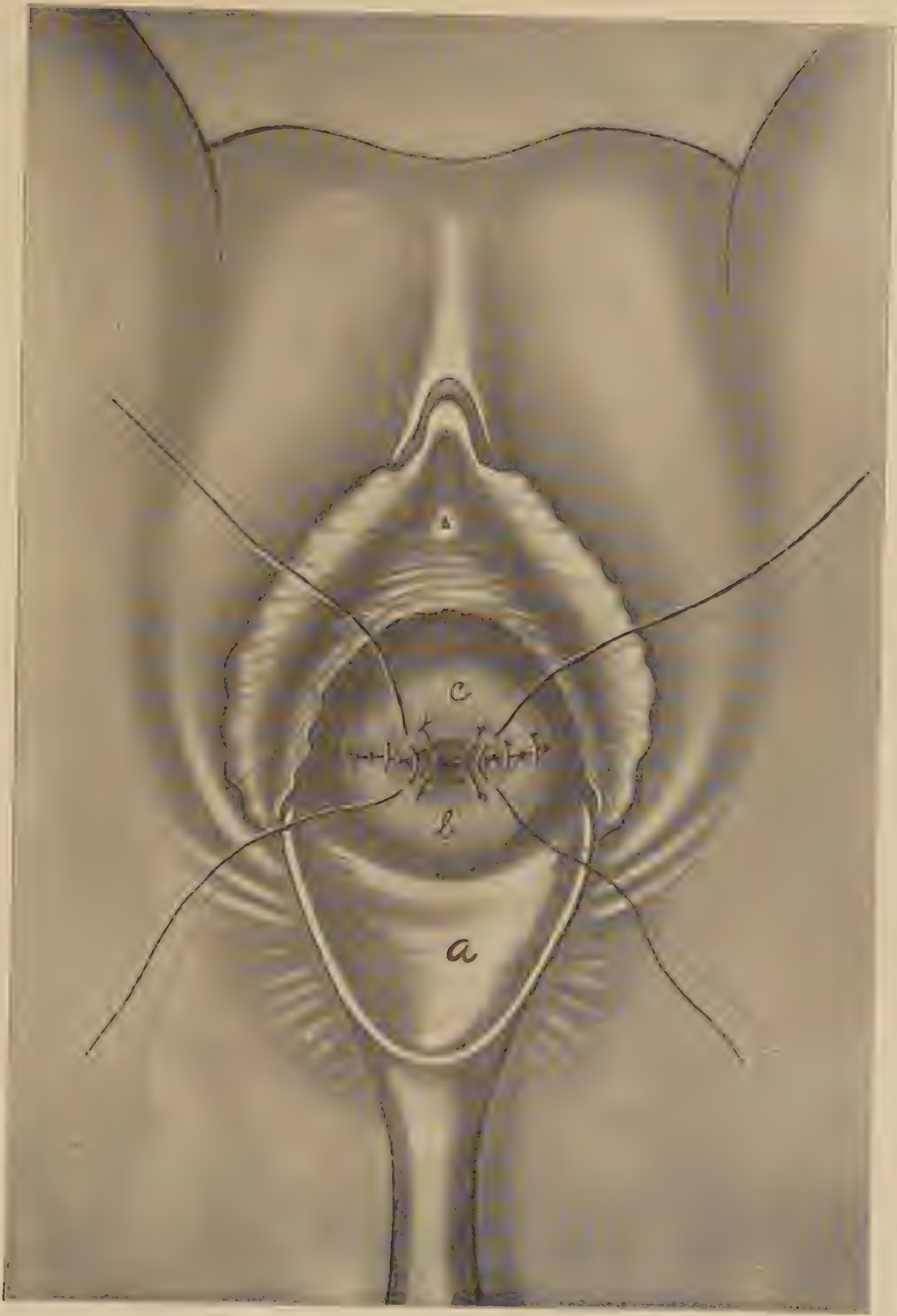


PLATE LXXIV

AMPUTATION OF CERVIX UTERI

This plate shows the operation as completed after all of the sutures have been tied and superficial sutures have been inserted to secure accurate coaptation of the mucous membrane.

should be done in the operation which might give rise to a recurrence of this state, even to a slight extent.

After the wound has healed the surface should be perfectly soft and covered with loose connective tissue, and the impression upon making a digital examination should be very similar to that which one obtains in making an examination of a cervix which has not been disturbed by pregnancy or confinement.

After the operation has been completed the uterus should be replaced in the normal position by means of bi-manual manipulation. It happens frequently that during operations the uterus has been drawn down considerably, and after the work has been completed it is quite out of place, and unless the surgeon takes the precaution of properly replacing the organ at the conclusion of his operation it is likely that it will remain out of place during the entire time that the patient is confined to bed. In this way considerable harm can come.

AFTER-TREATMENT.—The after-treatment consists of rest in bed for at least two weeks, the administration of from three to six large, hot douches a day, a light diet, and the use of mild laxatives.

PROGNOSIS.—In almost all of these patients there are other conditions which must be corrected, and the prognosis will be considered in connection with them.

LACERATION OF THE PERINEUM.

This deformity almost invariably accompanies the condition which has just been described, although if the patient has had the care of a physician during confinement the laceration is at present usually repaired at the time of its occurrence; consequently there are few old lacerations at the present time in patients who have this proper attention. These cases belong to a class in which the lacerations occurred at a time when the general practitioner was not so careful to examine and repair a torn perineum after confinement as he is to-day, and in a class of patients who are still being confined by the midwife.

HISTORY.—The history in these cases is the same as that which has just been given in connection with laceration of the cervix. The laceration may vary in degree, it may extend quite into the rectum for a slight distance, or for several inches, or it may extend only through a portion of the perineal body, or it may extend only through the upper or the lower portion—which can be determined upon inspection of the condition present or by making a digital examination. There may exist at the same time a bulging forward of the rectum between the ends of the lacerated tissues, the mucous membrane of the vagina and the wall of the rectum being carried forward by the pressure of the fæces in the latter, forming what is known as a rectocele. If this condition be present it usually interferes very seriously with the evacuation of the bowels.

In some cases, the skin and mucous membrane may have remained perfectly intact, and still with virtually no perineal support left, because while the skin and mucous membrane were not injured, on account of their elasticity, the transverse perineal muscles were completely torn and the levator ani muscles separated.

Operation.—A transverse incision is made through the septum remaining between the rectum and the vagina, and the tissues of the vaginal wall are carefully dissected loose from the tissues of the rectal wall, forming a large flap, which is carried forward into the vagina—the entire septum being split from side to side. After the incision through the skin and through a short distance of cicatricial tissue, which usually exists underneath the skin, the separation of these flaps can be accomplished most readily by grasping the vaginal flap with dissecting forceps and shoving away this section—the posterior flap—by means of the finger, covered with soft thicknesses of moist aseptic gauze. In this manner a flap, as shown in Plate LXXV, can be produced in a few moments. This exposes the tissues on each side which originally formed the perineum, and by carefully uniting these, after the manner to be described, a perineum can be constructed which will be as thorough a support as the original structure. The anterior flap is drawn forward and a row of interrupted tension sutures is applied, as indicated in the plate, the first suture beginning directly underneath the skin and grasping the submucous tissues successively and issuing on the opposite side directly underneath the skin. The last suture posteriorly is applied precisely in the same manner.

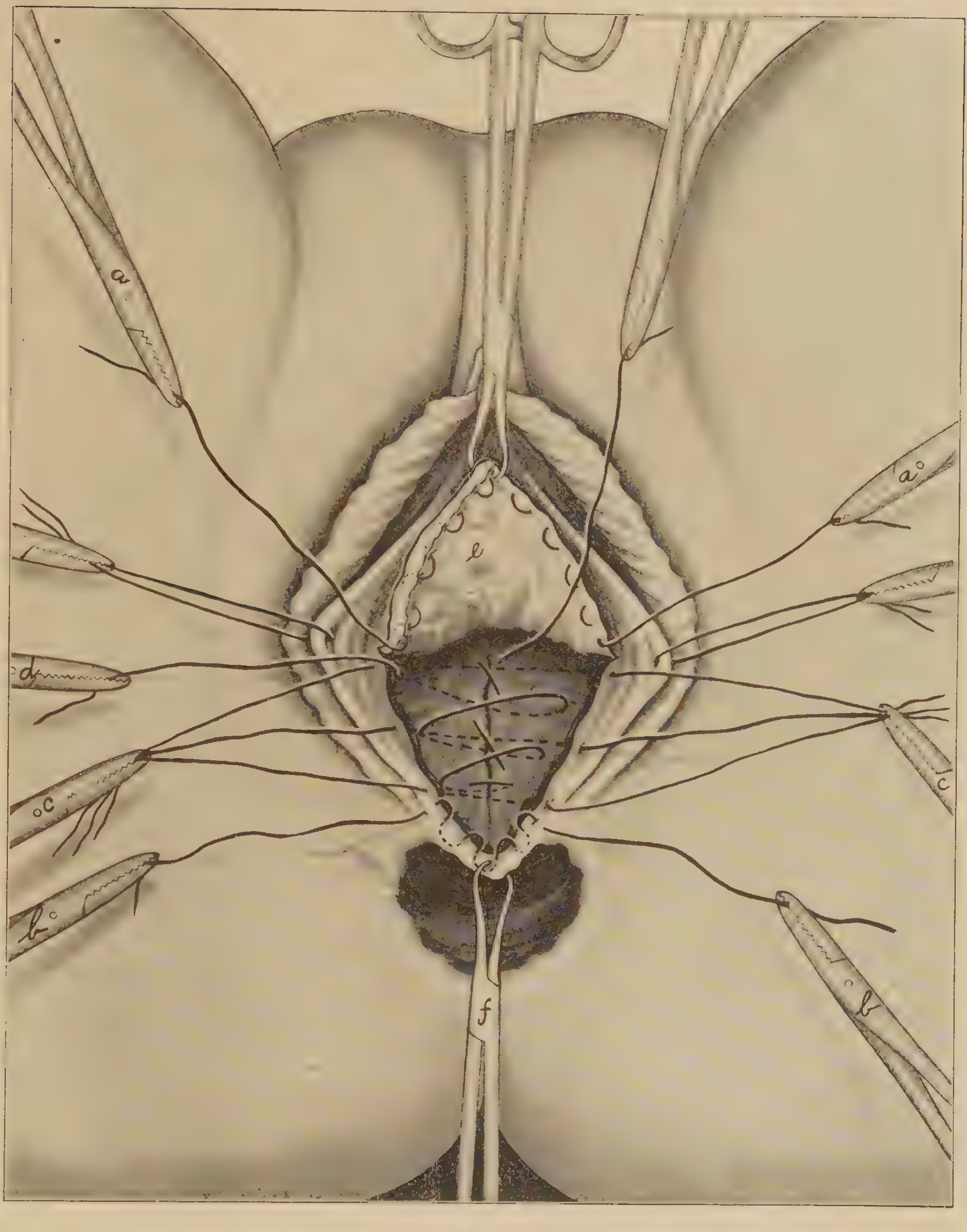


PLATE LXXV.
PERINEORRHAPHY.

The recto-vaginal septum has been split and the vaginal flap (e) drawn forward. A silkworm gut suture (aa) has been applied to the anterior flap, which, when tied, will make a new floor for the vagina. A similar suture (b) is applied to the posterior flap. These sutures extend to, but not through, the mucous membrane in either case. The sutures caught in the forceps, marked (c), pass through the lateral flaps, but they are left untied until each successive tissue on either side has been united with the same tissue on the opposite side by means of the continuous cat-gut suture marked (d). After the deep tissues have been united with the silkworm gut sutures (c) are tied.

It will be seen that after the first suture has been tied there will be a perfect floor to the vagina, no matter how deep the laceration may have been. The same is true after the last stitch posteriorly has been tied, there will be a new roof for the rectum, even though the laceration may have extended a considerable distance up into the same. It is plain that if these two stitches are properly applied that a recto-vaginal fistula after this operation is impossible.

The remaining deep stitches are inserted through the tissues on each side, beginning near the skin and passing down to a point just in front of the rectum, then passing over to the other side in front of the rectum and out through the tissues precisely opposite to the manner of introduction on the other side. From two to five of these sutures are inserted and left untied. Ordinary cat-gut sutures would undoubtedly suffice for this purpose, but in my own practice I have used chromicized cat-gut sutures, which will be absorbed after about twenty days. A continuous cat-gut suture is then introduced, as shown in Plate LXXV, for the purpose of uniting the tissues on each side to the corresponding tissues on the opposite, a small bite being taken with a short curved needle and care being exercised to avoid wounding the rectum.

It is important, again, to draw these stitches very loosely, for fear of causing pressure necrosis. The suturing can be done from above downward, then from below upward, then from above downward again, the same suture being used continuously.

After all the tissues have been placed in accurate coaptation in this manner, the continuous suture is tied and then the stay sutures are tied loosely over this, and then the skin is united carefully with a continuous cat-gut suture. It is clear that a rectocele cannot occur after this operation has been performed, because the space originally occupied by the rectocele is completely filled in by these sutures. This operation will give satisfactory results with any one of the various forms of laceration of the perineum enumerated above.

A considerable number of these patients suffer at the same time from hæmorrhoids. It is usually sufficient simply to dilate the sphincter ani muscles thoroughly before this operation is performed, in order to relieve the patient of that trouble. In cases where there are hæmorrhoids of considerable size, however, the operation which has already been described should be employed, but the hæmorrhoids on the anterior surface of the rectum should not be disturbed for fear of causing an infection of the perineal wound. In case a hæmorrhoidal swelling is directly on the anterior surface of the rectum, this invariably disappears after the perineum has been repaired, which is not always the case with those located on the lateral or the posterior surfaces of the rectum, hence the latter should be removed with clamp and cautery or with the ligature.

AFTER-TREATMENT.—The patient should remain in bed for at least two weeks, and if possible it is better to have her remain a week or two longer, because the benefit which is derived from perfect rest is quite important, and if this be prolonged somewhat it is quite worth while. Many of these patients also suffer from gastric disturbances; consequently they are greatly benefited by careful dieting, which can be carried out during their stay in the hospital without interfering with the progress of the recovery from the operation. In my own practice, I have found that many of these patients suffer at the same time from an inability to masticate their food properly, because during their long-continued illness they have not given needful attention to the preservation of their teeth. Among the class of working women in whom these operations are especially indicated one frequently finds that the mouth is filled with decayed roots, and it is consequently my plan invariably in these women to examine their teeth and during the anæsthesia to remove any decayed roots that may be present and to direct these patients after recovery from their operations to have the remaining teeth thoroughly repaired, and in case there are many missing to procure artificial dentures. This will also aid in building up these sufferers very greatly after the return home from their operations.

These patients should be especially cautioned against constipation, because this precaution will also aid greatly in securing for them a satisfactory recovery. If these various precautions are taken the prognosis is usually very satisfactory. A worn-out woman between the age of thirty-five and forty-five years usually recovers to such an extent that within a year or two she will readily be taken to be five or ten years younger than she was before the operation. In many of these cases there is at the same time a retroversion or retroflexion of the uterus, which can easily be corrected by making bi-manual manipulations, but in which the uterus will not maintain its corrected position for any considerable length of time.

Both of the operations which have just been described must usually be performed on the same patient. The result of the amputation of the cervix will be primarily to remove an amount of irritating cicatricial tissue, to remove a suppurating ulcerated surface, and this in turn will result in the natural absorption of the hypertrophy of the uterus, which is present at the time of the operation. Within a few months a hypertrophied uterus upon which this operation has been performed will usually be reduced to an almost normal size. This in itself will increase the likelihood of the organ remaining in its normal position. Then, further, the repair of the perineum will increase this likelihood still more, by supplying additional support for the uterus. In case, however, the retroversion or retroflexion persists after these operations have been performed, or if the tendency to these displacements is so great that it does not seem likely that they will be corrected by means of these two operations, then a third procedure is indicated for the direct relief of this condition.

In cases in which this tendency to retroversion and retroflexion exists the round ligaments which normally hold the uterus forward have been so severely stretched that they are no longer able to furnish normal support.

ALEXANDER OPERATION.

An incision three centimeters in length is made directly over the external abdominal ring in the direction of the inguinal canal. It is carried down through the skin and deep fascia to the fascia of the external oblique abdominal muscle. It is important that this incision be carried quite through the deep fascia, because if any portion of this fascia is permitted to remain undivided the surgeon may experience considerable difficulty in locating the round ligament.

After the fascia of the external oblique has been thoroughly exposed, the external abdominal ring can be located by palpation, as it gives the feeling of less resistance at this point than at any other. The fascia of the external oblique is now split in the direction of its fibers at this point, which will expose a small mass of fat directly in the external abdominal ring. If this mass of fat is now grasped by means of a pair of hæmostatic forceps, it will contain the round ligament, which may appear as a thread-like band, or may take the form of a cord of considerable size, sometimes as large as two millimeters in diameter. It is important to dissect this out carefully, because if once lost it may be difficult to find it again. This ligament should be examined carefully, and the genital branch of the genito-crural nerve which accompanies it should be separated because its destruction results in a paralysis of sensation in the parts to which it is supplied—which is likely to be the cause of considerable annoyance.

After the round ligament has been freed from its connective tissue attachments, it should be drawn up very gently until the infundibuliform process of the peritoneum becomes apparent. The ligament is then drawn out until it gives the sensation of drawing the uterus against the abdominal wall. Then a pad of sterile gauze is passed through under the ligament and the same steps are carried out on the opposite side. After both ligaments have been loosened and drawn up until this sensation of pulling the uterus against the abdominal wall is felt on each side, then each is relaxed for a distance of about two or three centimeters, in order to give the uterus the desired mobility, and a few stitches of fine chromicized cat-gut are passed through each ligament doubled upon itself in order to remove the slack in the ligament. Then a few stitches are inserted between the doubled ligament and the posterior surface of the fascia of the external oblique.

In case the inguinal canal has been stretched during the operation, the pillars of the canal are drawn together by a few stitches. The suturing of the fascia of the external oblique abdominal muscle completes the operation.

Much has been written concerning the likelihood of suppuration taking place in these operations. I believe that this is due to the fact that a considerable portion of the operation is performed upon tissues with slight vitality, and if with these the surgeon has a tendency to tie his sutures too tight the resulting pressure necrosis will supply an excellent culture medium for the micro-organisms. If the sutures are tied just tightly enough to secure coaptation, and not enough to cause pressure necrosis, there is no proneness towards suppuration in these cases.

After-Treatment.—If this operation is performed in connection with the last two which have just been described, no special after-treatment will be required. In case it is performed for the relief of retroversion or retroflexion of the uterus in cases in which there is no indication for doing the other two operations, then it is wise for the patient to wear a carefully fitted pessary for at least two months afterwards, so that the adhesions between the round ligaments and their new attachments will have become perfectly firm before any weight is placed upon them.

Prognosis.—If this operation is undertaken only in proper cases, namely, in those in which no force whatever is required in replacing the uterus into its normal position, cases in which the uterus can be retained in its normal position by means of a carefully applied pessary, the prognosis is almost invariably good. Then the operation does not interfere with a future pregnancy, and after delivery the uterus will maintain a normal position, showing that the changes during pregnancy have no tendency to destroy the benefits secured for the patient by this operation. It is important, I believe, that the uterus should be placed in the normal position by bi-manual manipulation before this operation is done. It also seems important that the round ligaments should not be shortened too much, in order to permit the normal mobility of the uterus.

OPERATION FOR VESICOCELE.

In this same class of cases, as has been stated above, there is also frequently an injury to the anterior vaginal wall, as well as to the posterior wall, consisting in a separation of the tissues supporting the bladder posteriorly. As a result of this injury the bladder will bulge into the vagina more and more, so that in extreme cases it may project in a sac-like protrusion from the vagina. This will result in retention of a certain amount of urine, in obstruction to the passage of urine, and as infection of this residual urine is likely to occur this condition usually results in the production of a cystitis. In case this affection is present only to a very slight extent, the operation which has just been described for the repair of a laceration of the perineum will usually suffice to support the bladder posteriorly, and as a consequence the symptoms resulting from the vesicocele will subside. In case the vesicocele is pronounced, however, this operation alone will not suffice. It will then become necessary to excise an elliptical portion of the anterior vaginal wall with its greater diameter extending parallel with the direction of the vagina. This will expose the ends of the torn tissues. The latter will be united by means of a continuous suture extending parallel with the direction of the vagina. If the lacerated tissues are thus united the mucous membrane of the bladder will contract and the vesicocele will be abolished. It is important, however, that there should be no pressure upon the sutures shortly after the operation, and in order to prevent this it is wise to insert a retention catheter directly after the operation, which will insure an empty bladder, and consequently absence of pressure upon the sutured wound. The perineum should be sutured simultaneously, in order to further support the posterior wall of the bladder.

After-Treatment.—The patient should be given large quantities of pure water to drink in order to dilute the urine and make it non-irritating, and to prevent the accumulation of phosphates in the catheter. A large, hot douche should be given from three to six times a day in order to keep the vaginal wound clean. In all other respects the after-treatment is the same as following the operations which have just been described.

The retention catheter is removed at the end of one and one-half or two weeks, but if there is any tendency of the bladder to become sufficiently distended to stretch the wound the catheter should be reintroduced.

Prognosis.—The prognosis after this operation is satisfactory unless it has existed for so long a time that the elasticity of the mucous membrane of the bladder has been destroyed.

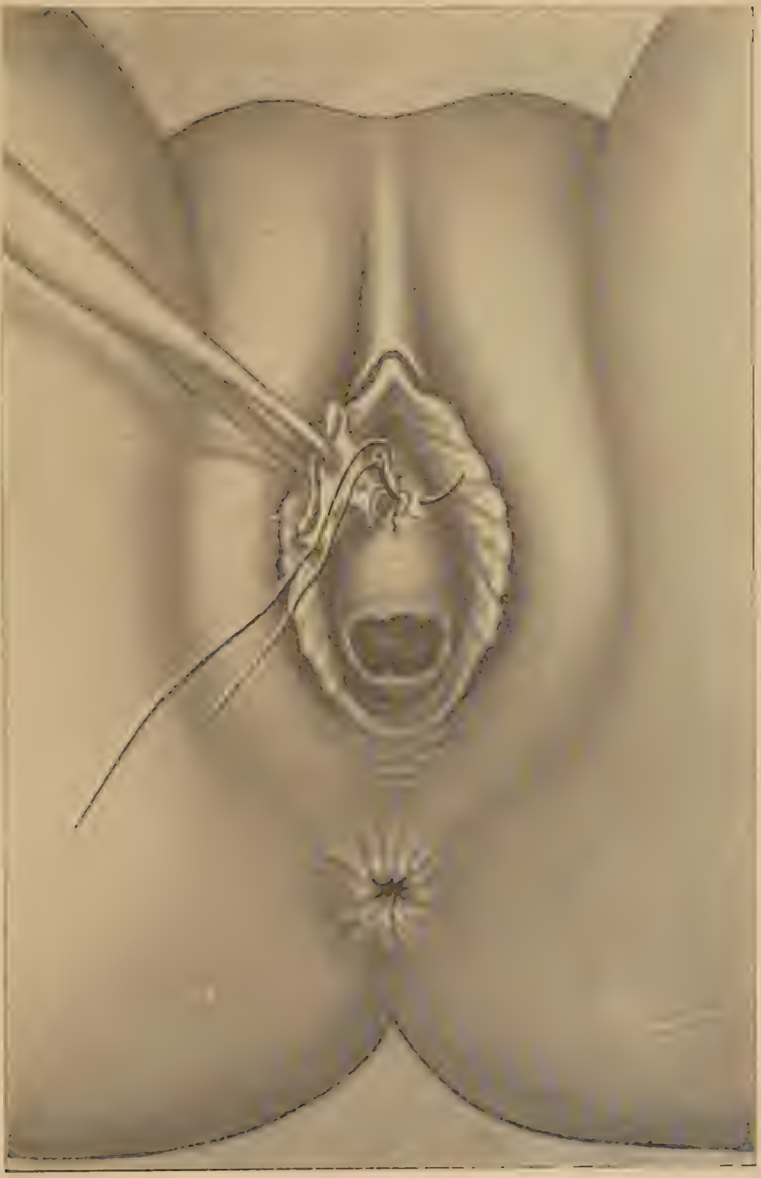


PLATE LXXVI.
EXCISION OF URETHRA.

The urethra has been dissected out and drawn forward with forceps and partly severed. The remaining stump is being sutured to the skin with interrupted cat-gut sutures, two sutures being in place and the third one being applied.

EXCISION OF THE LABIA MAJORA, MINORA AND CLITORIS FOR CARCINOMA.

In the presence of carcinoma of any one of these parts, the excision of the entire part, together with a considerable portion of the surrounding tissues, is indicated, but the most important portion of the treatment to be carried out consists in the careful dissection of the inguinal lymphatic glands, an operation which has been described in connection with carcinoma of the penis.

In my own work I have employed the electro-cautery or the Paquelin cautery for the removal of these growths, with the hope of preventing the inoculation of surrounding tissues that would or might follow the knife.

Prognosis.—A very extensive and thorough operation done early before the disease has progressed far, promises well for a permanent recovery, which is not the case when the disease is greatly advanced.

EXCISION OF THE URETHRA.

This operation may be indicated for the relief of epithelioma of the meatus, a condition which is not very uncommon, or for a prolapsus of the urethra. If the operation is performed for the relief of epithelioma the same precautions must be observed as in operations for the relief of epithelioma elsewhere. A sufficient amount of tissue must be removed to insure the greatest possible freedom from recurrence.

Operation.—A circular incision is made around the urethra for a sufficient distance to remove all diseased tissues. Then the urethra is dissected out upwards towards the bladder until a point is reached a sufficient distance from the disease; then the remnant of the canal is drawn forward and a stitch is applied between this and the outer skin, as indicated in Plate LXXVI. The urethra is then partly cut off transversely and a second stitch is applied a short distance from the first. In this manner the urethra is successively stitched to the skin and cut off until the entire structure has been severed. In this, as in every operation in which a tubular structure has to be brought forward and attached to the skin, it is best to apply a few stay sutures through the wall of the tube at some distance back from the outer end and to attach these stitches to the outer structures, so that but little tension is left for the stitches, which are applied immediately through the end of the tube and through the skin. In this manner there is much less danger of retraction from the tube and consequent constriction of its end than if simply a single row of sutures is employed.

In case it seems difficult to introduce a catheter through the opening for the purpose of emptying the bladder from time to time a small retention catheter may be introduced while the patient is still anæsthetized. This catheter is removed after a few days and the patient is usually able to empty the bladder spontaneously.

After-Treatment.—The after-treatment is the same as in cases of operation for cystocele.

VESICO-VAGINAL FISTULA.

History.—Patients suffering from this condition usually give the history of a long-continued labor with or without the use of forceps. Following this there has usually been retention of urine, and after this incontinence. It is rare that a leakage occurs directly after the delivery, indicating the fact that a rupture of the bladder has taken place at that time. In most instances the bladder wall is crushed only sufficient to become gangrenous after a time, but will support the urine for several days after the confinement.

At this point it might be well to state that in these cases the formation of the fistula might frequently be prevented if, directly after a delivery in which an unusual amount of pressure occurred, the conditions were made favorable for the restoration of the normal vitality of the crushed tissues. This would be greatly assisted by the introduction of the retention catheter, which would keep the bladder constantly empty and consequently would improve the circulatory conditions in this organ by removing the intra-vesical pressure. If, however, a portion of the posterior bladder wall and the anterior vaginal wall have sloughed away so that a vesico-vaginal fistula has occurred nearly at the time at which the patient comes under treatment, relief must come from a repairatory operation, unless the fistula be very small, in which case simple continuous drainage of the bladder will result in a healing of the opening.

Operation.—If the fistula be moderate in size it is necessary only to bring in coaptation relatively broad surfaces in order to secure a closure of the aperture. This can be accomplished by splitting the edge of the fistula in its entire circumference, then applying a row of fine cat-gut sutures to the mucous membrane, in order not to permit any portion of the suture to project into the bladder. A second row of sutures is applied to the connective tissue layer between the vesical and the vaginal mucous membrane. A third row of sutures is then applied to the vaginal mucous membrane. The bladder is then drained with a retention catheter and the after-treatment is carried out which was described in connection with the operation for vesicocele.

Prognosis.—If the fistula be moderate in size the prognosis is almost invariably good. If, however, the fistula is large the closure must be accomplished by plastic operations, portions of the mucous membrane being taken from various parts apparently most suited for that purpose, but if the entire posterior wall of the bladder has been destroyed its repair will require a great amount of skill in plastic surgery.

RECTO-VAGINAL FISTULA.

This condition is produced either by the opening of an abscess existing in the recto-vaginal septum into both the vagina and the rectum simultaneously, or by the causes which have been mentioned in conneection with vesico-vaginal fistula. The operation for its relief is virtually the same as that for the relief of vesico-vaginal fistula with the addition of a very thorough dilatation of the sphincter ani muscles in order to prevent pressure of the wound from the side of the rectum due to the retention of fæcal material on account of a tightly constricted sphincter. The after-treatment in these cases is the same as that which has just been described.

CYSTS OF BARTHOLIN'S GLANDS.

The occlusion of the ducts of Bartholin's glands, causing cysts, is of rather common occurrence and the result of this occlusion is the same as in case of the occlusion of the ducts of other glands. An accumulation of the mucus secreted by the gland occurs within the ducts, causing a distention of the gland which may increase to such an extent as to give rise to great inconvenience and sometimes to pain. The location of these cysts makes their infection quite likely, and consequently suppurating cysts of the glands of Bartholin is not an uncommon complication. This is especially true of patients who have suffered from gonorrhœal infection. These suppurating cysts may open spontaneously, and this may result in a spontaneous cure or in the formation of a fistula or recurrent abscesses.

Treatment.—The treatment may consist in a simple puncture of the cyst, but this will usually result only in temporary benefit, and is consequently unjustifiable, except where the patient must have immediate relief and cannot possibly subject herself to a radical operation, consisting in the excision of the entire cyst. For permanent relief an incision is made over the most prominent portion of the cyst, which is then dissected out from the surrounding tissues. With care it is possible to obtain the line of cleavage between the cyst wall and the surrounding tissues, and with a careful dissection the entire tumor can usually be excised without rupture. The space occupied by the cyst is then closed by means of a few buried sutures of cat-gut and a row of sutures uniting the mucous membrane, and the ordinary dressing is applied.

DYSMENORRHŒA DUE TO ATRESIA OF THE CERVIX.

In by far the greater number of patients suffering from dysmenorrhœa the cause is in the results of inflammatory conditions above the uterus. In considering appendicitis this subject was discussed and again in speaking of pyosalpinx, but there is a certain number of cases in which none of the inflammatory conditions affecting the tubes and ovaries are present and in which the cause of the dysmenorrhœa lies in an atresia of the cervix, or in a mechanical obstruction due to a short bend of the body of the uterus upon the cervix or in an inflammatory condition of the mucous lining of the uterus and cervix. In these patients the trouble can be relieved by thorough dilatation of the cervix, which should be repeated a number of times. The dilatation can best be started by inserting ordinary male urethral steel sounds, beginning with a size sufficiently small to enter the contracted cervix and increasing gradually until the largest size has been reached; then introducing a uterine dilator and stretching the cervix as much as it will bear without tearing. The dilator should be left in position under tension, then relaxed, then dilated again—and this should be repeated many times until the canal remains comparatively wide open after the dilator has been removed. In case there is a sharp angle between the cervix and the uterus it is well to dilate the cervix as much as possible without causing any laceration, and then to insert a tenotome and transversely cut the ridge opposite the junction between the body of the uterus and the cervix. In case there has been an endometritis which has resulted in the formation of granulation tissue within the uterus and the cervical canal this should be thoroughly curetted away with a moderately blunt curette and then it should be sponged with aseptic gauze. The uterine cavity should afterwards be tamponed with a piece of aseptic gauze moistened with ninety-five per cent. solution of carbolic acid. This should be left in place from two to five minutes and then withdrawn. Then the cavity should be tamponed with a piece of gauze saturated with strong alcohol. After this has been removed a piece of iodoform gauze may be carried up into the uterus in order to serve as a capillary drain.

After-Treatment.—The patient should be kept in bed for from one to two weeks and should receive from three to six large, hot douches every day, in order to relieve the congestion resulting from the operation. During the subsequent menstrual periods the patient should receive a mild uterine sedative during each period for a number of months. Patients suffering from this condition are likely to expect pain, and unless some sedative is given a slight amount of pain may be exaggerated by their nervous condition into a serious amount of suffering. On the contrary, if a uterine sedative is given, the patient will be entirely free from distress and will consequently soon cease looking for pain during these periods.

PROGNOSIS.—The prognosis will depend upon the cause of the dysmenorrhœa. If the cause was entirely in the cervix and in the uterus a very satisfactory result may be expected. If, however, it was in the tubes and ovaries then the result will be entirely negative.

Surgery of the Extremities.

OPERATIONS FOR THE RELIEF OF FRACTURES.

The scope of this work does not comprehend the treatment of fractures, except those in which operative interference is indicated. At the outset I wish to state that operative intervention is not indicated in any form of fracture unless the operator absolutely controls the conditions of sepsis during the operation, because an infection in operations for the relief of fractures is so much more serious than the fracture itself that if this cannot be absolutely eliminated the operation is, of course, not indicated.

FRACTURE OF THE PATELLA.

If the surgeon absolutely controls the situation so that he can be certain of asepsis, then in cases of fracture of the patella I believe the operative method is always indicated, because with it the patient can be out of bed in less than one week, he can walk about comfortably in three weeks, and in from six to eight weeks he will be able to follow any occupation which he may have had at the time of injury; while without operative treatment he will be disabled for many months at best.

The following case may illustrate this condition: A young man, forty years of age, fell upon his right patella and fractured it. He had it treated by means of splints and strapping, and obtained a very satisfactory result, which enabled him to follow his occupation as book-keeper in a large establishment at the end of six months; the knee, however, never became thoroughly strong, so that the patient could not take long walks without becoming exhausted. Two years later he fell upon the other knee and fractured the patella in the same manner. An open operation was at once performed and the extremity placed in a plaster of Paris cast. At the end of one week the patient was allowed to be out of bed. At the end of three weeks he was able to resume his work in the office, continuing, however, to wear a plaster of Paris cast. At the end of eight weeks his left leg was in a much better condition than his right, which had been injured two and one-half years before.

I have had an opportunity of making similar comparisons in fractures of the patella taking place in different persons at the same time, in numerous cases, and am convinced that with a clean operator an open method is as safe as the treatment with splints, and has all the other advantages which I have just mentioned.

Operation.—A transverse, curved incision is made with its center three centimeters below the point of the fracture of the patella. This flap is turned up, the blood clots which are found to be present are sponged away with moist aseptic gauze pads, the two fragments are then placed in accurate apposition, and the capsule to each side of the fracture is sutured by means of chromicized cat-gut sutures, which will last about two weeks. A few superficial sutures are then applied, which will hold the patella in accurate apposition, and the skin is sutured over all. A small plaster of Paris cast is then applied and the patient is placed in bed, with the extremity elevated. It is important that the extremity should be elevated, because this relaxes the quadriceps femoris muscle and consequently prevents the pulling upon the upper fragment by this muscle.

After six or eight days the patient is permitted to sit up out of bed, and after three weeks he is allowed to walk, with a cast upon the extremity. Five or six weeks after the operation the cast is removed and the patient is permitted to walk with a cane. It is neither necessary nor desirable that the patient should walk with a crutch at any time. In case there should be a certain amount of limitation of motion in the knee after recovering from this operation, which, in my experience, has been very rare, this can be overcome most readily by having the patient ride a bicycle, or a tricycle if he is not accustomed to the former. The result is so much better after this treatment than after the methods ordinarily in vogue that I believe it should become a recognized method, only, however, in the hands of clean surgeons.

FRACTURE OF THE OLECRANON.

The recovery from a fracture of the olecranon is ordinarily so much easier and the conditions after healing are so perfect if the fragments are applied by the use of catgut sutures, that in this case also an open operation is indicated.

Operation.—A longitudinal incision is made directly over the middle line of the olecranon process and the soft tissues are carefully retracted in order to avoid injuring the ulnar nerve. It is important at this point for the surgeon to bear in mind the relative position of the olecranon and the ulnar nerve, because if the operation is performed with the hand in the position of pronation the surgeon may be confused by the fact that ordinarily we carry the relations in our mind with the hand in the position of supination. The nerve mentioned passes between the internal condyle and the olecranon, but when the hand is pronated so as to place the olecranon in a convenient position for operation, then the internal condyle is turned to the outer side. If this fact is borne in mind the nerve can be very easily avoided. Here, again, the fragments of bone are united by means of chromicized cat-gut, which will last about fifteen days. In case a sufficiently firm hold can be obtained by passing these sutures through the periosteum and the surrounding soft tissues to retain the fragments in perfect juxtaposition that is all that will be required. If this cannot be done a small opening should be drilled through the middle of the olecranon process and through the upper end of the ulna, and a suture should be passed through this. The arm should be dressed in the extended position by means of a plaster of Paris cast.

FRACTURE OF THE ACROMION PROCESS.

In case of fracture of the acromion process, in which it is found difficult to maintain the proper position, an incision should be made parallel with the spine of the scapula, the fracture should be exposed with as little disturbance of the soft tissues as possible, and the fractured end should be sutured in place, if possible, by passing the sutures through the soft tissues. If it is not possible to firmly adjust the fragments in this manner small openings should be drilled into the end of each fragment and at least two chromicized cat-gut sutures should be applied in order to secure a perfect coaptation.

FRACTURES OF THE OUTER END OF THE CLAVICLE.

In very rare instances a fracture occurs near the outer extremity of the clavicle which cannot be retained in any reasonable position by means of dressings ordinarily used for this purpose. In such case the most superficial portion of the bone should be sought, namely, upon the line between the attachment of the trapezius muscle and the deltoid, and an incision at this point should expose the fracture, which can then be readily adjusted by means of a few cat-gut sutures. After these have been applied the skin is sutured and a rubber adhesive plaster is applied upward from the chest, covering both fragments and extending backward over the scapula. The arm is then placed in a sling and carried in this position for a period of three to six weeks.

In the same region occasionally a severe traumatism causes a dislocation of the outer end of the clavicle, loosening its attachment to the acromion process of the scapula, the acromio-clavicular ligaments being completely lacerated. Ordinarily this dislocation can be reduced by means of properly applied rubber adhesive straps, but in case such a result is found impossible then the incision which has just been described for the treatment of a fracture of the outer end of the clavicle should be made, the dislocation reduced, and the ruptured acromio-clavicular ligaments carefully sutured with chromicized cat-gut. The dressing which has just been described in connection with the rubber adhesive plaster dressing should be applied and a second broad strap of rubber adhesive plaster should be adjusted as follows:

Beginning about the angle of the eighth or tenth rib the rubber adhesive plaster is passed upwards and outwards, so that its middle portion strikes the end of the clavicle. It is then carried forwards and downwards and passed around the forearm four centimeters below the end of the olecranon process with the arm in the flexed position. In this manner the leverage of the arm upon the adhesive plaster straps serves to hold down the end of the clavicle in position and relieves the tension upon the chromicized catgut sutures.

EPIPHYSEAL FRACTURES.

In case of epiphyseal fractures in any portion of the skeleton in which, after careful manipulation under anæsthesia, it is found impossible to adjust the fragments, it is desirable to resort to an open operation at once—always providing that the surgeon completely controls the conditions of sepsis. The deformities which occur after these fractures are unusually annoying, because of their proximity to the joints. This fact, of course, makes the open operation more hazardous, but the benefits of the operation are so great in those cases in which, after careful trial, it has been found impossible to adjust the fragments, that the surgeon is justified in taking the additional risk. In cases in which the fractures have not been adjusted there will be found a retardation of growth from the epiphyseal line involved, aside from the deformity. Whether this can always be avoided by an open operation it is impossible to say with the relatively small amount of clinical observation upon this subject, but in cases in which the operation has been done the results have been much more satisfactory than in those cases in which the irreducible deformity has been permitted to persist.

COMPOUND FRACTURES.

In compound fractures, the most important point to be considered is the production of conditions as nearly as possible like those in simple fractures. These conditions can be accomplished most readily by laying the wound open sufficiently to remove the extraneous matter which may have been forced into it at the time of the injury or in the manipulations which occurred before the patient entered the hands of the surgeon. After the wound has been carefully disinfected and the fragments which are entirely loose have been removed, those which have some attachment to the periosteum being carefully adjusted, the fragments should be placed in as nearly a normal position as possible, and if it seems likely that this position can be maintained by the use of external splints, then it seems proper that such external splints be applied. If, however, it is clear that this position of the fragments cannot be maintained then the same should be sutured in place by means of cat-gut sutures.

In my own practice I have for a number of years applied strong tincture of iodine to all of the injured tissues involved in compound fractures, and have then applied strands of iodoform gauze down to the point of fracture and have permitted them to project from the outer wound. This has been done because it has been claimed by good authorities that in the presence of iodine, and especially in the presence of iodoform, the development of the tetanus bacillus is much less likely than under any other form of treatment. Personally, I am well satisfied with this method, being careful, however, to thoroughly cleanse the surfaces with large quantities of hot water and with a 1 :2000 solution of corrosive sublimate. Other surgeons have equally satisfactory results with other methods, and consequently I do not feel justified in giving this as one which should be generally adopted as being better than any other. The dressings should be applied so that they can be removed without disturbing the relation of the fractured ends.

UNUNITED FRACTURES.

In the treatment of a large number of ununited fractures I have invariably found that the ends of the fragments were separated by some intervening fascia, muscle or cicatricial tissue. These cases are almost always in patients who have sustained an exceedingly violent injury, so that the ends of the bones have been forced beyond each other with great violence.

PROPHYLAXIS.—In many instances during the original reduction of the fracture one observes the fact that after the fracture has apparently been corrected, the moment the surgeon's grasp upon the extremity is loosened a marked deformity occurs and that the ends of the bones show no tendency to become engaged against each other. This condition is, I believe, frequently an indication that one or the other end of the bone has been forced through some of the surrounding soft tissues, and that the moment the tension upon the extremity is relaxed this soft tissue causes the fragments to slip past each other. If this point is regarded and overcome during the reduction of fracture I believe many cases of non-union may be avoided. The soft tissues are usually forced in between the ends of the fractures at the time of the injury, except in cases of compound fracture in which a considerable portion of bone is entirely lost, leaving only soft tissues between the two fragments.

In case a fracture does not unite within any reasonable period of time the following operation is indicated.

An incision is made at some point at which the bone can be approached without interfering with any important anatomical structures. The soft tissues intervening between the ends of the fractured bone are then completely dissected away, so that the ends of the bone are free with the exception of the connective tissue which has formed over these ends. This connective tissue is then cut away by means of a sharp carpenter's chisel and both ends of the bone are chipped in many places with a small sharp chisel. In case it is possible to retain the fragments in apposition by simply suturing the periosteum to the surrounding soft tissues, this should be done. If this cannot be accomplished the ends should be perforated with at least two small parallel holes each, and through these chromicized cat-gut sutures should be passed and carefully tied. The periosteum is then sutured over these and the soft tissues over all. The fragments are then further supported by the means employed in the treatment of ordinary simple fractures. The ununited fracture has thus been reduced to a simple fracture with the additional advantage of having the ends held in perfect apposition. The fracture is then treated as a simple fracture. In the transition from an ununited to a simple fracture it was changed temporarily into a compound fracture which is safe only under conditions of absolute asepsis, as before pointed out and emphasized.

Prognosis.—Ordinarily the prognosis in these cases is very favorable, but occasionally the surgeon encounters a case in which all methods for the purpose of securing union of an ununited fracture seem useless. If the ununited fracture is in the lower extremity it is wise to apply an ambulatory splint, so that the patient will be enabled to walk upon the extremity within a few days after the fracture has been adjusted. It seems that better results can be obtained in this way than where the patient is required to lie quiet for a number of weeks. Various remedies have been recommended in these cases, but in my experience none of them has been of any benefit to the patient.

OSTEOMYELITIS.

History.—Patients suffering from acute osteomyelitis usually give a history of a sudden attack of pain, most frequently at the point of entrance of the nutrient artery or near one of the epiphyseal extremities of one of the long bones. This attack usually occurs after exposure to wet and cold.

In many cases it is possible to trace a history of follicular tonsillitis as the source of the infection. The pain is extreme upon pressure and most extreme early in the disease at one particular circumscribed point. The patient suffers from high fever and feels thoroughly ill, having the general appearance of one suffering from acute sepsis. The pain becomes more and more diffuse and the extremity becomes swollen and later on œdematous and reddened, and ultmately fluctuation will appear. In a very large proportion of these cases the early diagnosis is that of localized rheumatism, and, *vice versa,* conditions giving rise to a diagnosis of localized rheumatism near the center of a long bone or near one of the epiphyseal lines practically always means that the patient is suffering from acute osteomyelitis. In many of these cases the disease seems to have been located by a slight traumatism. Of course, it is always necessary to bear in mind that the osteomyelitis may have existed and that the traumatism was a coincidence.

Treatment.—It is necessary only to bear in mind the pathological conditions present in order to determine the proper treatment. There is a violent circumscribed infection which, if left undisturbed, is certain to progress along the blood vessels and lymph channels and become more and more diffuse. The bone is surrounded by a tense membrane, the periosteum, and consequently the products of the infection cannot easily escape, and the pressure which is caused by these against the sensitive periosteum gives rise to the excruciating pain. It is plain, then, that in order to secure relief from pain conditions must be established providing for the escape of the products of infection within the periosteum. This can be accomplished most readily by making a long incision through all of the tissues down through the periosteum. This treatment at once permits the septic material to escape, it relieves the pressure, stops the pain, and it directs the lymph stream away from the body and therefore prevents the progress of the infection.

A number of years ago many excellent surgeons at once removed the infected bone. In many instances the entire shaft of one of the long bones was found diseased and entirely removed, and it seemed as though this was the only logical way of treating so intense an infection. However, experience has taught the fact that in these cases in which large portions of bone in acute osteomyelitis were removed there was no reproduction of new bone to take the place of that which had been removed, and consequently the extremity was left without any bony support. On the other hand, it was found that if the periosteum was simply split open the recovery was exceedingly rapid from the acute attack and that many times a bone which seemed entirely lost regained its vitality and continued to perform its physiological functions, while in other instances a bone which seemed entirely destroyed regained its vitality to a great extent and it was later necessary to remove only a small portion of necrotic osseous tissue. Again, it was found that so long as the diseased bone was left in place there was rapidly produced between this portion and the periosteum a layer of new bone known as the involucrum, which in a few months became strong enough to substitute the diseased bone after this was removed, and in such cases the reproduction of bone after the removal of the necrotic bone tissue progressed to such an extent that almost the entire structure was reformed. Moreover, those who have frequently operated upon osteomyelitic bone have found that even without the aid of drainage, resulting from the incision which has just been described, almost all of these patients suffering from acute osteomyelitis recover and become chronic and that then it is possible to remove the diseased bone and still leave a perfectly useful support for the extremity in the form of the new involucrum.

In all cases of acute osteomyelitis, then, the primary operation must consist in an incision extending some distance beyond each end of the infection in the bone and must penetrate all the tissues down to the bone, including the periosteum. The drainage can be still further improved by the application of large, moist antiseptic dressings to the extremity and, of course, complete rest. A saturated solution of boric acid or of acetate of aluminum, or a thirty per cent. solution of alcohol in hot water, are most useful fluids for this purpose. The entire extremity should be enveloped in this dressing and should be covered with an impervious substance like oiled silk or gutta percha tissue or an ordinary rubber cloth. Fresh solutions should be added three to six times a day. The dressing itself need not be removed more than once every two to four days. The pain subsides almost instantly, and within a few weeks the incision usually heals with the exception of a circumscribed point in case the bone does not entirely recuperate.

Only rarely the surgeon sees a case of osteomyelitis at the very beginning of the attack, when the infection is still confined to a limited area one or two centimeters in diameter, which can be located because of the extreme tenderness in a very circumscribed point. In these rare cases the bone should be opened with a very sharp chisel. The infected tissue should be gouged and scraped out with great care and the cavity filled with ninety-five per cent. carbolic acid for five to ten minutes and then thoroughly washed with strong alcohol. The skin may be sutured over this directly or the cavity may be tamponed for a few days and then sutured secondarily.

In the event of a circumscribed portion becoming necrotic it should be left in place until it has been thoroughly covered by an involucrum, which is developed between the necrotic bone and the periosteum. After this has become sufficiently strong to support the extremity it should be treated after the method which will be described in connection with chronic osteomyelitis.

CHRONIC OSTEOMYELITIS.

History.—Patients suffering from this condition most commonly give a history of acute osteomyelitis, which may have been treated after the method just described, or, more frequently, it may have been diagnosed as acute localized rheumatism and treated accordingly. In many cases the condition has progressed to the formation of an abscess, which may have opened spontaneously or have been laid open by the surgeon. The sinus resulting from this abscess refuses to heal entirely or it may heal and open from time to time, the patient feeling comparatively comfortable whenever the sinus is open and suffering from pain when it is closed.

The infection may be due to one or more of the pus microbes or to the typhoid bacillus or to the pneumococcus or to the bacillus of tuberculosis. In case the latter form of infection exists alone the onset and the progress of the disease is usually slower than if the infection is due to any of the other micro-organisms which have been mentioned.

The condition must be differentiated from syphilitic osteitis or periostitis. The latter condition is preceded by the history of syphilis or of hereditary syphilis, or there may have been a syphilitic infection without any obtainable history. The progress of this condition is, however, slow; it is characterized by less acute or rather more deep-seated pain, which is likely to be more severe at night than during the day-time. The characteristic mark of this disease, however, is the spindle-shaped appearance of the diseased bone and the tendency to elongation and to bending of the bone, in case the long bones are involved which is not very common except in the tibia and occasionally the femur. Syphilis more commonly attacks the flat bones; tuberculosis the joints, the epiphyses and the short bones; while osteomyelitis most commonly involves the long bones.

The diagnosis of syphilitic osteitis or periostitis can be eliminated by the administration of large doses of iodide of potash continued for a period of from two to six weeks. If no distinct improvement occurs the condition is probably not due to syphilis. Very rarely is there any difficulty in making a differential diagnosis between osteomyelitis and sarcoma, because in the latter condition there is the distinct formation of a tumor.

TREATMENT.—The treatment of chronic osteomyelitis consists in laying bare the diseased bone, reflecting the periosteum, chiseling away a sufficient amount of the involucrum to permit of the removal of the necrotic bone; then the involucrum should be chiseled away in each direction sufficiently far to permit of the complete removal of all infected tissue. The granulations should be curetted away until the surface of bone is perfectly smooth and free from any of these structures. During the chiseling operation it is frequently necessary to employ great care to prevent the production of a fracture, because if the entire shaft of the bone has been necrotic the involucrum is frequently not strong enough to bear any severe strain.

In planning an operation for chronic osteomyelitis one should, if possible, arrange to leave the conditions so that a sufficient amount of the involucrum can safely be chiseled away to leave the space caused by the removal of the sequestrum entirely on one side of the bone, so that there will remain no cavity which cannot be filled by the falling in of the surrounding soft tissues. If, however, the conditions present will not permit this, the ledge of bone on one side or the other of the groove formed after the removal of the sequestrum should be chiseled parallel to the bone, remaining attached, however, to its periosteum, so that the entire ledge can be folded in against the remaining portion of the bone which is continuous above and below with the healthy structure. This prevents the formation of a cavity with unyielding walls and will facilitate healing after the operation for chronic osteomyelitis very greatly. After all of the diseased tissue has been removed the surfaces of the bone may be swabbed with ninety-five per cent. carbolic acid, which may be left in contact for from two to five minutes, and then the cavity should be thoroughly washed with strong alcohol to remove the superfluous carbolic acid.

It has been my custom to apply strong compound tincture of iodine to these surfaces after the alcohol has been sponged away and then to close the wound with sutures and to apply a large antiseptic dressing, and to support the extremity by means of a splint.

If, however, there is doubt about the complete removal of all the infected tissue, it is much wiser to tampon the cavity with iodoform gauze, and, if it is found aseptic after a few days, to close the wound by secondary sutures.

In cases which have been operated repeatedly without permanent success, it is especially desirable to obliterate the medullary canal completely in order to leave no space which may become the seat of a new infection or may contain a focus of the old infection. This can be best accomplished by chiseling away the entire portion of bone forming the walls of the medullary canal, except on one side. It is not necessary to retain much bone, because repair will begin at once, and in a few weeks the bone will again have its normal size. It is, however, important to exercise care not to fracture the bone during the operation. The patient should be kept thoroughly under the influence of the anæsthetic, because a sudden motion on the part of the patient may result in a fracture.

SEPTIC INFECTION OF THE EXTREMITIES.

History.—The patient before you is forty-eight years of age, works in a lumber yard, and gives the following history: His family history is negative. He suffered from the ordinary diseases of childhood; four years ago he had penumonia, but otherwise he has always been well. Four days ago the patient noticed a slight swelling of his left thumb, which was ascribed to the fact that two weeks ago a small "sliver" of wood entered at the point of the swelling. At first he paid no attention to his condition, but last night he suddenly began to feel exceedingly ill. The swelling extended rapidly over the entire hand, and red lines indicate the course of the superficial lymph channels along the palmar surface of the arm to the axilla. There is a very small point at which the sliver entered the end of the thumb. All the infected portions are exceedingly tender.

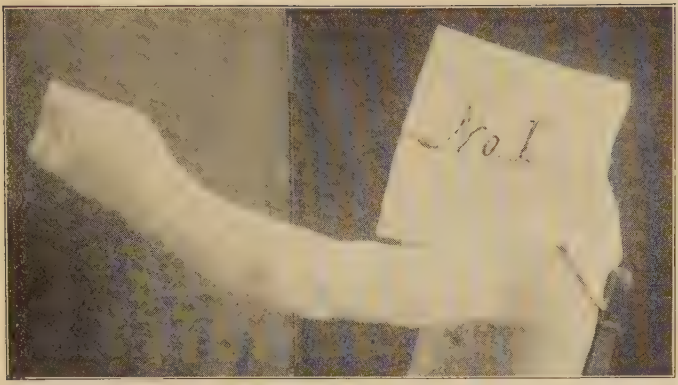
The patient is a strong, well nourished man. A physical examination shows his heart, lungs, kidneys and abdominal organs to be normal. His temperature at the present time is 102½ F., pulse 124, respiration 20. He has the appearance of being exceedingly ill. During the past night he was delirious, and his friends state that his fever was very high—although the temperature was not measured.

If this patient were permitted to sit up or walk about with some small local dressing applied to his thumb, I am certain that in a few days he would develop a palmar abscess, and judging from the extension of the swelling at the present time, this would later be followed by an abscess of the forearm, and still later the axillary glands would suppurate.

Every practical surgeon has made the following observation in these patients many times, and probably also upon himself. A slight infection of the finger occurs from a prick with a needle or from some other slight injury. During the day the finger, and even the hand, becomes painful. The next morning the pain has entirely disappeared and the patient imagines himself well; but during the day the pain returns, possibly a little more severe than the day before, and on the following night it again disappears, only to a less extent. After a few further repetitions a serious infection may become established, resulting in the destruction of a considerable amount of tissue, which will probably be followed by a marked impairment of the function of the extremity.

The explanation is very simple. During the day when the extremity is frequently moved the infectious material is carried from its circumscribed area to the points farther up the arm. The following night this progress is again inhibited, because of the complete rest in the muscles of the arm, and there is a corresponding diminution in the symptoms. If the rest be continued the progress is permanently inhibited and the patient recovers completely. If this is not done it will ordinarily advance until the patient is so ill that rest is compulsory.

Treatment.—Our treatment will consist in carefully cutting away the thickened skin over the point of the thumb in order to permit any infectious material which may still exist at the original point of entrance to escape. The great danger to the patient, however, comes from the infection which has already extended beyond the original area, and we will consequently apply to the entire arm the dressing shown in Plate LXXVII. The patient will also



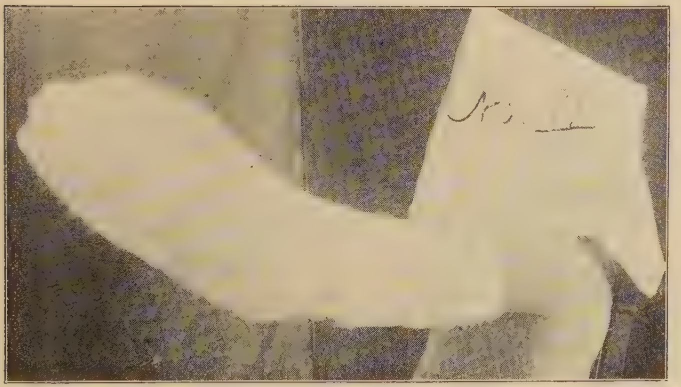


PLATE LXXVII.

LARGE, MOIST ANTISEPTIC DRESSING.

Each finger is first separately covered with gauze. Then the entire hand and arm to the shoulder are wound loosely with gauze, then with cotton, all being saturated with a mild antiseptic solution. The entire dressing is then covered with rubber cloth or some other impervious material. The patient should be in the recumbent position and the extremity elevated. The object of the picture is to show the extent and size of the dressing.

receive a cathartic, in order to remove from his alimentary canal any products of decomposition which might depress his general condition. As a result of this dressing, combined with absolute rest, we will expect the temperature to be practically normal within two days, and the worst consequence that can happen consists in a circumscribed, harmless abscess that will heal within a few days after being laid open.

Even the severest infections of the extremities, such as are likely to result from wounds received at post mortems, pin pricks or slight abrasions, nail punctures, etc., will subside within a few days if the two very simple conditions indicated above are established. The more important of these is rest. The septic material is carried from the original point of infection through the lymph channels. It is, however, a fact which has been repeatedly demonstrated, that this progress is very slow if the extremity remains perfectly at rest, and much more rapid if the muscles of the arm are active, because their contractions virtually pump the micro-organisms onward in the lymph channels. If a patient suffering from an infection of the hand or finger is placed absolutely at rest the inflammation will remain nearly stationary, even if there be no further treatment, while as soon as the patient begins to use the extremity there is a marked exacerbation of the inflammation. This condition I have observed many dozens of times.

The next important point in the treatment consists in the application of very large, moist, antiseptic dressings. It does not matter whether the infection be slight or severe at first, one cannot feel certain that it will not increase in severity, and this increase in severity may be followed by very unfortunate results—such as palmar abscesses, necrosis of the tendon sheaths with the subsequent deformity and stiffness, or the axillary glands may become infected and be destroyed by suppuration, and this may be followed by pyæmia and death. This, however, will not be the case if the extremity is put absolutely at rest as soon as the diagnosis is made and a large, moist, antiseptic dressing is applied. Plate LXXVII illustrates this dressing. It consists of five to ten yards of soft, antiseptic gauze, loosely rolled around each finger separately, then about the hand, wrist, forearm and arm to the shoulder. This is surrounded by a pound of absorbent cotton, and this by a rubber cloth, to confine the moisture and retain the temperature. Fresh antiseptic solution is poured into the dressing every one to six hours in order to keep the extremity constantly in contact with this fluid.

The dressing is renewed once in forty-eight hours and the entire extremity carefully inspected to locate circumscribed abscesses which may form, although the vast majority of these cases get perfectly well without the development of an abscess. Occasionally the condition may be such as to make it desirable to inspect the extremity after twenty-four hours, but usually it is better to leave the dressing undisturbed for a longer period. In case an abscess has formed this is laid open, care being taken not to open into any of the surrounding healthy tissue, for that is likely to result in a progressive infection. Above all things these extremities should not be squeezed or manipulated during the dressing. I have frequently seen a patient's temperature rise several degrees, and the infection progress to a marked extent, after such manipulations. It is painful to observe a surgeon inflicting upon one of these patients what might be termed diagnostic massage, and forcing the septic material out of its fairly circumscribed and consequently harmless position into the surrounding tissues.

The slightest touch will suffice to indicate the presence of a defined accumulation of pus, and still one frequently observes a physician squeezing and crushing these inflamed tissues for several minutes, to no purpose whatever apparently, while he is collecting his sluggish thoughts. It is well to remember that much harm can be done in this manner.

If there is a deep-seated abscess on the palmar side of the hand it can easily be located by gently pressing. There is, however, no doubt but that it is much better for the patient if these abscesses are opened a little too late than a little too early, because their contents become much less virulent from day to day and if the extremity is kept at rest there will be no progressive infection.

I have recently looked up the cases of severe infection of the fingers which I have treated in one hospital during the past two years, and find that there were forty-six during that time, and of this entire number there was not one coming to us without an

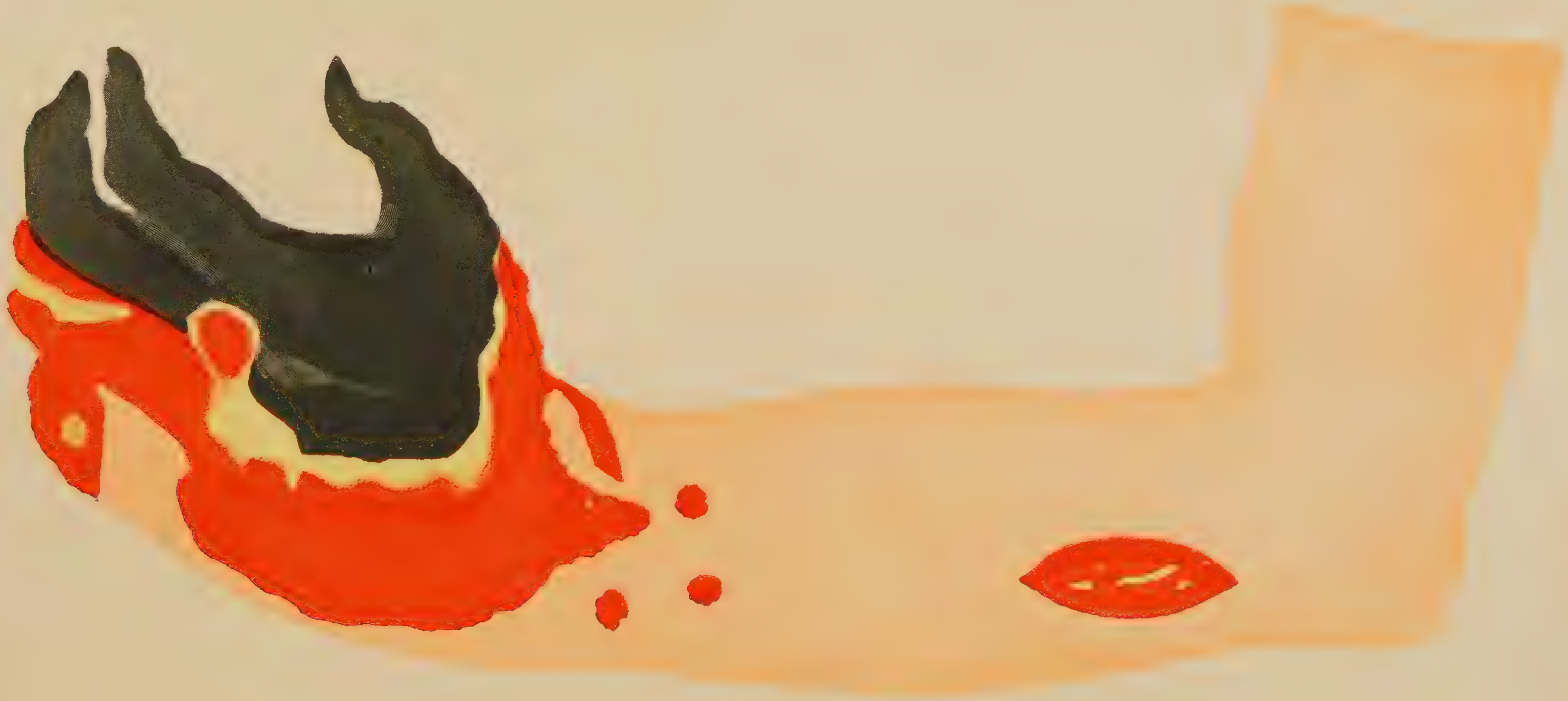


PLATE LXXVIII.

Gangrene Following Septic Infection.

The first and second finger and the thumb are gangrenous. The skin on the back of the hand, along the edge of that which is perfectly black, is also necrotic, but not through its entire thickness; beyond this is a red area in which the skin is beginning to recover. On the forearm there is another red area, representing an incision into a circumscribed abscess.

incision of the palm or forearm whose hand was disabled as a result of the infection or the treatment; while among those who had been treated with small dressings of any kind and without absolute rest and with the palms or forearms incised before entering the hospital, deformed and stiff hands were the rule.

We have made extensive observations with a large number of these cases and have found that the patients have progressed most favorably when the following antiseptic solution was poured into the dressing every one to six hours:

Boric acid, saturated solution in water.......	Six parts.
Carbolic acid, five per cent. solution..........	One part.
Alcohol, ninety-five per cent................	One part.

It is astonishing how rapidly a most violent, progressing infection of the extremity will be changed into a perfectly stationary, harmless affection if the two conditions mentioned are thoroughly applied.

Plate LXXVIII illustrates the condition of a hand in a young, vigorous farmer, who, about thirty hours before entering the hospital, had produced a slight injury with a dirty file while repairing some portion of an old halter.

During this short time the infection had made such violent progress that the patient seemed to be in a hopeless state. He was delirious, his entire arm to the shoulder was œdematous and red, his hand was severely swollen, the fingers indicated in the plate as gangrenous were already black, and this condition had progressed upwards rapidly. Under the treatment that has just been described, the line of demarkation formed as shown in the plate, there was no further progress in the infection and the œdema subsided rapidly. Before entering the hospital a small dressing had been applied. Until the patient became delirious he was permitted to walk about the room, which he did in the hope of reducing his suffering. As usual, the pain in this case subsided rapidly after the form of treatment before mentioned was employed, and there was no progress of the disease, although this had been constant and very rapid previously. I have chosen this case because of its great violence.

VARICOSE VEINS OF THE LOWER EXTREMITIES.

The presence of varicose veins in the lower extremities is accompanied with a great amount of pain to the patient, and will usually result, sooner or later, in the formation of an ulcer of the leg, because of the lack of nutrition in the circumscribed areas drained by the lower end of the saphenous veins. In case both the superficial and the deep veins are varicose, there will be marked œdema of the entire lower extremity, and in these cases no operative treatment is of any avail. These patients will progress most comfortably if the bed is so arranged that the lower extremities rest upon an inclined plane regularly at night. This relieves the impaired veins of much of their burden and they have an opportunity to recuperate slightly during each night. In the morning, before the extremities are lowered, well fitting elastic stockings should be applied, in order to support the veins. It is important that the extremities be carefully measured in order that the stockings may fit accurately, and that the measurement is taken after the patient has rested in bed for a number of days with the legs elevated, so that all of the œdema may have disappeared. In case there is only circumscribed or superficial œdema, the condition usually depends upon the incapacity of the valves in the superficial veins, namely, the external or internal saphenous, or both. In this event, the patient can usually obtain permanent and perfect relief if these veins are excised, especially if in addition to such excision all the superficial veins are severed transversely. This can be accomplished by making a circular incision through all of the tissues down to the deep fascia and then uniting the wound in the skin by means of sutures throughout. It is still better if the incision is carried through the skin and superficial fascia and the veins down to the deep fascia about the middle of the leg, throughout the circumference, with the exception of an inch opposite the spine of the tibia, and the same distance on the posterior surface of the leg. The superficial fascia and the veins between the skin and the deep fascia at these points can be severed by passing a knife under the skin with the cutting edge downward. This will prevent a circular scar extending entirely around the leg. A further improvement in this operation consists in making the incision obliquely instead of exactly at right angles with the leg. The operation is performed with a constrictor applied to the thigh, so that there can be no hæmorrhage during the operation, and it will not be necessary to ligate any of the veins, the constrictor not being removed until the dressing has been applied and the patient placed in bed, with the extremity elevated.

EXCISION OF THE SAPHENOUS VEINS.

The internal saphenous vein is more commonly affected than the external. In order to determine the extent of the excision the patient should be permitted to stand erect for a few minutes and the point noted to which the vein is enlarged. It should then be excised to a distance several inches above this point.

Operation.—The extremity is elevated and held for several minutes until the veins have become entirely empty. Then an Esmarch constrictor is applied to the thigh high up and the vein is laid bare by an incision extending over the entire distance through which it is enlarged. The uppermost end is then dissected free, grasped with two pairs of hæmostatic forceps and cut between and the upper end is ligated. The vein is then dissected out downward throughout the desired length; the larger communicating branches being caught with forceps and ligated, or they may be left open with safety. After the entire vein has been excised the wound is closed and a large antiseptic dressing is applied, so that the pressure upon the wound will be uniform and mild. The constrictor is not removed until the patient has been placed in bed with the extremity elevated. The extremity should be left in an elevated position for at least one week after the operation, and then it should be slowly lowered. At the end of the second week a soft flannel bandage may be applied and the patient may be permitted to be about. It is well for the patient to wear a flannel bandage, applied every morning before the foot is lowered, for a number of months. It is also wise for the patient to sleep with the extremity elevated upon an inclined plane in order to relieve the deep veins during the night.

VARICOSE ULCERS.

If the veins have been varicose for quite a period of time, especially in patients working hard or in those who are likely to subject their extremities to traumatism, an ulcer is apt to form on the lower extremity. So long as the patient remains upon his feet, and so long as nothing is done to relieve the condition in the veins, such an ulcer is unlikely to improve. If, on the other hand, the patient is placed in bed with the lower extremities elevated upon an inclined plane, the pressure relieved from the veins and consequently the return circulation favored, the area occupied by the ulcer becomes better nourished and healing is promptly favored. The same is true after the excision of the varicose veins and the circular incision through all of the superficial veins, provided the ulcer has not existed too long and has not become of such a size that its covering with epithelium is impossible. The floor of the ulcer will become composed of a mass of hard, connective tissue, the result of an attempt at cicatrization of the ulcer, and it is difficult for epidermis to grow over this surface.

In these advanced cases of long standing, it is better to excise this conective tissue and to cover the entire surface with Thiersch's skin grafts, at the same time that operation is performed for the relief of varicose veins. By the time the wound of the latter operation is healed the skin grafts will have firmly adhered to the raw surface and the patient is at once relieved of the ulcer.

SKIN GRAFTING.

This operation is indicated wherever a surface is deprived of a sufficient amount of skin to make a spontaneous covering impossible or in cases in which it would require too great a period of time, or in cases in which the skin which would be formed in this manner would not be sufficiently substantial. It is also indicated in cases after the removal of tumors in which so much of the overlying skin has to be removed as to make it impossible to bring the edges properly together. In these instances the operation of skin grafting can be carried out at once, provided the hæmorrhage can be sufficiently stopped at the time of the operation. The same is true after the excision of troublesome scars over burns or injuries.

Operation.—The success of the operation depends:

1. Upon absolutely aseptic conditions.
2. Upon securing a bloodless surface on which to graft the skin.
3. Upon the accurate application of the skin grafts; and
4. Upon the fact that the grafts have not been injured by contact with any antiseptic solution between the time of their being removed from the normal skin and the time of their application to the raw surface.

The area from which the skin is to be removed should be prepared as carefully as though any other operation were to be done in this vicinity. The most convenient place from which to obtain skin is the outer surface of the thigh. The skin is removed by means of a sharp razor, preferably with a wide blade, which is held parallel with the surface of the extremity, being permitted to slide upon the thigh. The thickness of skin to be removed is regulated carefully by the method of holding the razor. The skin should be stretched so as to make it as tense as possible. Then a layer should be shaved off by means of a sawing motion. This layer should contain the epidermis and a thin portion containing the tops of the papillæ.

The portion cut is permitted to fold itself upon the surface of the razor until a sufficiently long strip has been removed to extend across the ulcer to be covered. This can be calculated very easily, so that each successive strip will extend quite across the ulcer. Neither the skin nor the razor nor the surface to be grafted upon should be wet. If this precaution is taken union between the surfaces will take place almost instantly.

The plan which has been practised so long of covering the razor and the skin and the portion to be grafted with normal salt solution reduces the chances of rapid and perfect union.

In order to spread the graft over the area to be covered most conveniently the sharp edge of the razor should be placed in contact with this surface, and while the graft is being pulled off this edge by means of a needle fastened in a pair of hæmostatic forceps the razor is slowly moved across the surface. In this manner the graft will be almost perfectly spread without any further manipulation. The edges can be still further adjusted by means of a pair of needles fastened in hæmostatic forceps. It is well to let the delicate edges of these grafts overlap a little. After the entire surface has been covered with a series of these sections it is protected by the application of a network of rubber adhesive strips from two to three millimeters in width. These will at once protect the underlying skin grafts and at the same time make it possible for drainage to take place between these pieces. A dressing of sterilized gauze is placed over these strips and held in position by means of rubber adhesive straps. A thick layer of absorbent cotton is then placed over all and held in position by means of a soft roller bandage.

AFTER-TREATMENT.—The wound is not disturbed for one week, when the dressings are thoroughly moistened and removed without disturbing the grafts. It is important that the dressings be not pulled upon because at this time the attachment between the grafts and the raw surface is still very slight, and if the dressing is performed carelessly enough harm can be done to destroy a portion of the new skin.

After the dressing has been removed, together with the rubber protective strips, a similar toilet to the one first applied will be used, and at the end of a second week, when this is again removed, the wound is usually found perfectly healed. If this plan is carried out it will not be possible to distinguish, after the wound has healed, the different grafts that have been applied; the surface being perfectly smooth, there will be no traction thereon, and it will be sufficiently firm to bear the ordinary abuses to which the skin is exposed.

NERVE SUTURES.

Nerve suturing should be employed in cases in which a nerve is severed accidentally during an operation, in cases in which a portion of nerve had to be excised together with some malignant growth, in cases in which a portion of nerve has been severed or destroyed by traumatism, and occasionally in cases in which a nerve has been caught between the ends of a fractured bone and has been destroyed by the presure due to the formation of callus. If the nerve be sutured immediately after it has been severed the operation will simply consist in adjusting the nerve ends and then applying a sufficient number of fine cat-gut sutures to hold them in perfect coaptation. It does not matter whether these sutures are passed through the trunk of the nerve or whether they simply include the sheath of the nerve. The important point is to have the ends of the nerve carefully approximated. It is well to adjust over the line of suture in the nerve a convenient piece of fascia, which can be obtained in the wound, by means of a few fine cat-gut sutures.

In case a portion of nerve has been destroyed by some traumatism the difficulty is easily managed, because one of the principal conditions which must be obtained in order to secure success is the absence of tension upon the nerve ends. In cases in which the ends cannot be adjusted absolutely without tension the distance between the nerve ends should be bridged over in the following manner:

The nerve ends are cut off squarely; then a very fine cat-gut suture is passed back and forth between the divided extremities, each time passing through the end at a little distance from the previous point of perforation until a bundle of cat-gut has been produced approximately the size of the nerve which is being sutured. This should be applied so that there is absolutely no tension upon the sutures, which should lie loose between the two nerve ends. When a sufficient amount of this cat-gut has been thus arranged the ends are tied and the entire bundle of cat-gut, together with the two nerve ends, is covered by reflecting a flap of fascia over them and attaching them to some of the soft tissues beyond by means of a few fine cat-gut sutures. By this method I have secured perfect functional results in a case in which as much as three inches of the ulnar nerve had been destroyed by a gunshot wound, and in a number of other cases I have had equally satisfactory results with this form of grafting nerves by means of intervening cat-gut sutures. In case the nerve has been severed for a period of time the conditions are still further complicated because the ends of the nerves are now covered with connective tissue, and in order to secure satisfactory functional results it will be necessary to remove absolutely all of this connective tissue.

The tendency in these operations is always to cut away too little of such tissue in order not to increase the distance between the ends too greatly. Many failures are undoubtedly due to this disposition.

With a section through a relatively healthy nerve and a distance of an inch or more between the ends the chances for a satisfactory functional result are much greater than with the ends directly sutured together, if all of the conective tissue which has resulted from the healing of the nerve stump has not been removed.

I would, therefore, emphasize the importance of cutting away a sufficient amount in cases in which nerve grafting is practised a considerable time after the nerve has been severed. Here again it is important to bear in mind that a condition of tension is the worst possible one to be obtained in nerve suturing.

The surgeon will often encounter no small amount of difficulty in finding the nerve ends directly, if the operation is performed some time after the injury has occurred, because the traumatism itself and the subsequent healing has usually disturbed the relations to such an extent that the nerve cannot readily be discovered by searching for it in its normal anatomical position.

The proximal nerve end is usually considerably enlarged and can, therefore, be found more easily, because it can be felt through the other tissues. This is not the case with the distal nerve end, however, which is rarely enlarged at all. It is always wise in these cases, if the nerve end is not found at once, to locate the nerve in its normal position at some distance from the point of injury and then follow it down to the point at which it has been severed. It is not necessary to loosen the nerve entirely from its attachments in doing this. All that needs to be done is to free its superficial surface and to follow this down to the end.

If the nerve has been included in callus, resulting in a paralysis of the portion beyond the seat of the fracture, and was not injured directly at the time of the fracture, then the paralysis will have come on slowly and will not have existed directly after the time at which the injury occurred. For this reason it is important to obtain a perfect history in these cases, for it frequently happens that a nerve is surrounded by callus, and as this increases in firmness the pressure upon the nerve results in a paralysis. If this nerve is laid bare and the callus chiseled away the nerve may be released from its grasp, and unless it has been held in the callus for a lengthened period of time its function will then be restored. In order to prevent it from again becoming compressed in the callus it should be carried to some distance from the original point of incarceration and surrounded by some of the soft tissues, which will prevent its slipping back into the groove from which it has been removed. The same precaution should be taken in case the nerve has been entirely severed and the ends caught in the callus. Too much stress cannot be laid upon the importance of carefully observing cases of paralysis following fracture, because much greater success follows an early than a late operation.

Prognosis.—In cases in which the nerve is sutured directly at the time of the injury, both the immediate and the remote results are good. Sensation may return within a few hours after the operation and motion will begin to return within a few weeks, and may be perfect within three months. If the operation be performed several weeks or months after the injury, then sensation may return within a short time, but unless the action of the muscles is maintained by means of electricity or massage atrophy is likely to occur and the patient will recover but slowly from the paralysis of motion. In some instances the recovery from paralysis of motion may occur as late as one or two years after the operation was performed, and the functional result may continue to improve for a very long time. The prognosis is relatively much better the nearer the terminal end of the nerve the injury occurs; consequently the suturing of one of the large nerves does not give nearly so good a prognosis as the suturing of one of the smaller ones.

TENDON SUTURES.

In case a tendon is severed and sutured immediately the result is almost invariably satisfactory, providing the wound remains aseptic. It does not matter what method of suturing be employed so long as the tendon ends are in apposition. It is, however, best to insert the sutures in such a manner that they cannot readily split the tendon end longitudinally. This can be best accomplished by passing the suture into the tendon end, then out through one side, then passing it a short distance across the tendon, and then into the tendon again.

If a considerable portion of a tendon has been destroyed the ends may be united in the manner described for uniting nerve ends at a distance. The functional results in these cases are surprisingly good. I have repeatedly united tendon ends more than six inches apart with perfect functional results in cases in which theoretically one could expect nothing but failure. It is, however, of the greatest importance to avoid tension.

In cases in which a tendon is contracted it may be lengthened by splitting it longitudinally in halves, then cutting off one of these segments in one direction at the end of this longitudinal incision and the other segment in the opposite direction at the other end of the longitudinal incision, then stretching out the tendon and uniting the two segments which have been produced in this manner. In this way any desired amount, which does not exceed double the original length, can be very easily obtained. The tendon very quickly becomes firm and the functional results are highly satisfactory.

In cases in which the operation is performed immediately after a tendon has been severed the greatest difficulty is encountered in finding the tendon ends, which usually retract a greater or less distance within their sheaths. If a closed pair of forceps be passed up through the sheath until it reaches the point at which the tendon end can be felt and the forceps are then opened, this end can usually be caught and brought down. In case this cannot be done an incision may be made opposite the point to which the tendon has retracted and a stitch may be passed through the tendon end and threaded in the eye of an old-fashioned probe, and this may be carried through the sheath of the tendon, and then by drawing on the suture the tendon end can be brought down and united to the distal end. In case the end cannot be located the sheath may be split until the end is reached. It is then brought down and united and the sheath is sutured over it with fine cat-gut sutures. Usually this does not result in any adhesions between the sheath and the tendon unless the wound becomes infected.

In applying sutures to tendons tension should be avoided and the sutures should never be tied tightly enough to cause pressure necrosis, because tendon is a tissue not well supplied with blood, and consequently easily injured in this manner.

This healing condition can be further favored in applying the dressing with the extremity in the most favorable position for obtaining a relaxation of the muscles belonging to the tendons which have been sutured.

TUBERCULOSIS OF THE JOINTS.

This condition is characterized by its slow beginning, by its usual limitation to one joint, by the tendency to fixation of the joint, and, later, by the atrophy of the muscles, both above and below the affected part. Its location is often determined by a traumatism, although this cannot always be established, and in the cases in which there is a history of injury the surgeon cannot always exclude the possibility of coincidence.

The condition is usually secondary to tuberculosis of the respiratory tract, the alimentary tract, the tonsils or the lymph glands, the bacilli having been carried to the vicinity of the epiphyseal line of the bones or the joint surfaces by the blood-stream. This being the case, it is of the greatest importance that the surgeon's attention be primarily directed toward the improvement of the patient's general condition, which can be best accomplished by improving his hygienic surroundings, his nutrition and his habits of life; and by administering tonics and concentrated foods and some form of creosote. Above all things he should not be permitted to continue to live under the conditions which primarily gave rise to his disease. These points are of great importance, not only in obtaining a recovery from the immediate disease, but also for the purpose of securing permanency of cure. It is virtually always necessary to change the dwelling of these patients, if not the climate, to change their food, to regulate their hours of rest, and frequently their occupation. This having been accomplished, the treatment of the joint involved will depend upon its location and the extent to which the disease has progressed; but in any case as nearly complete rest as possible for the joint is the condition most to be desired, especially if this can be obtained without confining the patient to bed. If the disease is in an incipient stage, rest alone, with the conditions described above, will usually suffice to produce a recovery.

A light cast made out of plaster of Paris, very carefully constructed, and strengthened by incorporation of thin strips of tough wood, such as are used in the manufacture of market baskets, is usually the most desirable dressing, unless the patient can afford the use of a similar dressing manufactured out of aluminum. The cast should be applied over some elastic woven material, arranged in a double layer, in order that the friction of the cast which adheres to the outer layer will not be directly against the skin, but against the second layer, which will remain free.

If the ankle or the knee joint is involved, it is best to draw two closely fitting stockings upon the extremity.

The cast should be worn for a number of months after the joint is apparently perfectly well.

In case of the hip joint the treatment by fixation with a plaster of Paris cast should be supplemented by the use of weight-and-pulley extension, to be applied at night, for a period of at least two years after the joint has apparently fully recovered, because this seems to prevent recurrence, to prevent deformity, and to increase the comfort of these patients, and to remind them of the necessity of avoiding traumatism for a considerable time. The extension is made by applying a strip of rubber adhesive plaster from eight to twelve centimeters in width, to the inner, and to the outer surface of the entire thigh and leg, and holding them in place by a roller bandage. These plaster strips are attached to the cord which passes over the pulley to the weight, by means of two cords attached to a cross-piece of wood eight to fifteen centimeters in length. The lower end of the bed should be elevated from ten to twenty centimeters, in order to secure counter-extension from the weight of the body. The weight employed should be from one-tenth to one-fifth of the weight of the body, the correct amount being determined by the comfort of the patient. It is well to begin with a light weight and to increase it gradually.

In case rest and hygienic measures alone are not sufficient to obtain a cure of the condition, which can usually be determined by the fact that there is an increase in the pain, or that the swelling does not subside, or that a point of fluctuation appears in the vicinity of the joint, then it will become necessary to open the joint and remove the diseased tissues, consisting of portions of the capsule, the synovial membrane and cartilage of the joint, and in advanced cases usually some portion of bone.

In many cases the radical operation may be postponed until the treatment by means of injection with a mixture of iodoform and glycerine has been tried. This treatment will be described presently.

Operation.—In children, the least possible amount of tissue should be removed, because in a great majority of cases this will suffice to produce a cure quite as frequently as if a more extensive operation is made, and because the less tissue removed the less will be the deformity, and the less the likelihood of impairment in the future growth of the extremity.

In adults the conditions are somewhat different. Here an excision of a sufficient amount of bone to insure anchylosis after the operation is much more likely to insure a satisfactory outcome, especially in the hip and knee joints, both as regards permanency of cure and preservation of function.

The anchylosis favors strength and the absence of motion gives freedom from pain. The permanency of cure depends to no small degree upon the fact that any slight focus of infection which may have been overlooked is much less likely to be kindled into activity if the joint is perfectly placed at rest by the anchylosis. Moreover, the excision of a sufficient amount of bone to secure this condition increases the likelihood of a complete removal of all the diseased tissue. After the diseased tissue has been completely removed, the raw surfaces should all be thoroughly and repeatedly swabbed with a ninety-five per cent. solution of carbolic acid for a period of five minutes, then the superfluous acid should be washed away with strong alcohol. After this, it is well to apply strong compound tincture of iodine to the entire surface, and then a ten per cent. solution of iodoform and glycerine, after which the wound is to be closed with deep sutures of cat-gut and superficial sutures of any desired material. In case any doubt exists as to the aseptic condition of the joint when the operation has been completed, the same should be freely drained with rubber tubes or with iodoform gauze passed transversely through the articulation. The joint is then covered with a large dressing and immobilized by the use of plaster of Paris or with splints.

All the joints of the upper and lower extremities, with the exception of the shoulder joint and the hip joint, are operated after the application of an Esmarch constrictor. This facilitates the work greatly and it is an easy matter to avoid all the important blood vessels during the operation, hence it is not necessary to remove the constrictor before suturing the wound and applying the dressing. If, however, there is any fear in the mind of the operator that there may be some hæmorrhage later, it is always best to remove the constrictor before suturing the wound and to carefully grasp all bleeding joints with artery forceps and ligate them before closing the wound.

RESECTION OF THE ANKLE JOINT.

Nothing has been said concerning the operation itself in connection with each joint, because the typical operations outlined in every text-book are quite as satisfactory as any operation I can describe, with the exception of the method for resection of the ankle joint. The operation which is here described is not generally practised, but any surgeon who has once tried this mode will always continue to employ it, because it insures a most satisfactory approach to the diseased tissues, and the results of the operation are most satisfactory, both as regards the functional effects and permanency of cure. This is true even in cases which seem quite hopeless with any other method.

Operation.—An incision is carried directly across the anterior surface of the ankle from malleolus to malleolus through the skin, superficial and deep fascia and the sheaths of all of the tendons in the course of the incision. Externally the peroneal artery and nerve should be avoided, as well as the tendons of the peroneal muscles, which can readily be drawn out of the way. Internally the posterior artery and nerve should be protected. Each tendon is then lifted up in the incision and transfixed with two fine cat-gut sutures from one to two centimeters apart. These sutures are caught in similar artery forceps for purposes of identification, then the tendon is cut transversely between these sutures. After all the tendons have been disposed of in this manner, the joint is opened by a free transverse incision and the sole of the foot is forced back upon the calf of the leg. In this manner the entire joint is opened freely, so that all diseased tissue can be removed. After this has been accomplished, as described in connection with the treatment of tuberculous joints in general, the foot is placed in position, the tendons are carefully adjusted, which can be done with great ease, because the two sutures upon two corresponding tendon ends are fastened to hæmostatic forceps of the same pattern. Each tendon is carefully sutured and a fine stitch is placed in the fascia to cover the line of suture in the tendon. Then the skin is sutured over all. If drainage seems necessary, this is applied through and through, and even in cases apparently requiring no drainage, I have usually passed a few strands of cat-gut or silkworm gut entirely across the foot, permitting the ends to protrude from the lower angles of the wound in order to drain the serum which may be secreted by the large surface during the first few days. A large dressing is applied and the foot is immobilized in a position at a little less than a right angle.

After-Treatment.—The foot is elevated in order to favor return circulation. If drainage has been employed, this is left in place from one to two weeks. The dressing is not changed, unless this is indicated by the discharge, for a week or ten days, in order to avoid moving the foot, and after that as seldom as possible for the same reason.

Prognosis.—The prognosis is very good after this operation. The free exposure of the surfaces insures thoroughness, and consequently the cure is usually permanent. The anchylosis of the surfaces immediately in the field of operation does not interfere with movement because the tarso-metatarsal joints will supply the motion necessary. The tendons unite readily and act normally. There is no operation for the relief of joint tuberculosis that has given me more satisfaction than this one just described. With this method it is often possible to obtain a useful foot in cases which formerly could only be relieved by an amputation.

At the present time it is possible to obtain artificial limbs, in case of amputation at the lower third of the leg, which are so excellent that unless one can obtain a good result after a resection of the ankle an amputation is to be preferred.

TUBERCULOSIS OF THE SHOULDER JOINT.

The shoulder joint deserves some especial attention, because it is least useful when anchylosed, and consequently an operation for the relief of tuberculosis of this joint must be performed in a manner which will prevent anchylosis. This can be accomplished by stripping back the periosteum upon the shaft of the bone, then cutting away the head together with two or three centimeters of the shaft of the bone, and afterwards covering the end of the bone with the periosteum, which has been stripped back, together with some fascia.

In the treatment of tuberculosis of the *elbow joint,* the social and economical condition of the patient must be considered. An anchylosis at a little less than a right angle will produce the most useful and the most powerful arm for a laboring man or a mechanic, but the awkward position will interfere with the patient's appearance. If a patient desires the greatest amount of power and usefulness, the arm should be dressed at a little less than a right angle. If he is willing or desirous to sacrifice these qualities for the sake of obtaining greater beauty, a sufficient amount of bone should be removed to insure a movable joint, the ends of the bones being again covered with soft tissues.

The *wrist joint* should be dressed as nearly straight as possible.

The *hip* should be dressed with the extremity in the abducted position, the foot extending as nearly straightforward as possible, both inversion and eversion being avoided. This precaution considerably overcomes the tendency to shortening. This position can be secured by means of a plaster of Paris dressing or by a weight-and-pulley extension, combined with the use of a Hodgen's splint with a foot-piece attachment, which will insure the vertical position of the foot.

The *knee* should be dressed in a slightly flexed position, because this secures the greatest ease in walking.

TUBERCULOSIS OF THE SACRO-ILIAC JOINT.

Tuberculosis in this joint is characterized by lameness, which at first is apparent only during, or more frequently the day after, severe exertion.

A misstep or a quick motion is likely to give rise to pain. The patient usually imagines the pain to be located in the hip at first and percussion over the great trochanter is apt to give rise to pain. There is, however, no suffering upon motion of the hip, flexion, extension and rotation being normal and painless, unless the motion is very sudden and sufficiently violent to affect the ilium. There is no pain upon pressure over the hip joint, but pain is present when pressure is made over the sacro-iliac articulation, or when compression of the pelvis is made. There is frequently an evening temperature.

Treatment.—The same principles are employed in the treatment of tuberculosis of this as in the other joints. In many of these cases the use of hygienic measures and rest will result in a cure. Injection with iodoform emulsion gives very favorable results, and in case a sinus is formed cauterization frequently produces a cure. It is rather more difficult to obtain a thorough removal of all the diseased tissue in cases in which the joint is extensively involved and in which the measures mentioned above have failed to produce a cure, than in tuberculosis of other joints.

In these cases it becomes necessary to avoid injuring the sciatic nerve if the bone is so extensively diseased as to approach this structure. In my own cases the results have been best when I have thoroughly removed all of the diseased bone, then treated the cavity with strong carbolic acid, then with alcohol and then tamponed with iodoform gauze, which was removed after a week, when the cavity was treated with strong tincture of iodine and sutured secondarily.

The patient should be kept in bed until the tissues have become firm, because motion is likely to disturb the newly-formed tissues and cause a recurrence.

AFTER-TREATMENT IN CASES WHICH DO NOT HEAL PRIMARILY.—In case the wound does not heal primarily, the sinuses may be stimulated by the injection of strong compound tincture of iodine, of ninety-five per cent. carbolic acid, followed with strong alcohol, or of two to ten per cent. solutions of nitrate of silver in water.

It has been claimed that these sinuses will heal much more rapidly if exposed daily to the influence of the X-ray for a period of fifteen minutes at a distance of twelve to fifteen centimeters. I have not tried this method in a sufficient number of cases to be entitled to an opinion, as the possibility of coincidence must not be overlooked.

In a number of instances I have seen rapid and permanent healing after touching these sinuses thoroughly with the actual cautery, the point of the cautery being introduced into the sinus, permitting the heat to radiate to the surrounding tissues. This is much better than to attempt to touch all of the infected parts directly.

A rod of iron the size of a lead-pencil, heated to red heat in a gas or alcohol flame, or in a coal fire, or a tinsmith's heater, serves this purpose admirably.

Before introducing this rod into a sinus, the direction and depth of the latter should always be determined by means of a probe, in order that the cautery may be readily introduced in a manner which will insure the cauterization of the sinus throughout its course without destroying healthy tissues.

MIXED INFECTION IN TUBERCULOUS BONE AND JOINT DISEASES.

So long as the entire infection is due to the bacillus of tuberculosis, the progress of the disease is slow, and except in cases in which the pressure within the capsule of the joint gives rise to severe pain, the patient usually does not give the impression of being very ill, unless the affection is complicated with other troubles, such as tuberculosis of the lungs. If, however, the disease becomes complicated by infection of the abscess with other pathogenic micro-organisms, the condition of the patient at once becomes much more serious. He acquires the appearance of one suffering from a degree of sepsis, depending upon the form and extent of the infection, and his general condition becomes more grave rapidly, which is usually first recognized by the appearance of the characteristic hectic flush.

It is a singular fact which has been constantly demonstrated clinically, that a tuberculous abscess may open spontaneously and may discharge through a sinus for weeks or months, or even years, without becoming infected with other pathogenic micro-organisms, while a similar abscess would become infected almost at once if opened by an incision. This is of great practical importance, because it illustrates the point that by a simple incision the surgeon can in a moment change a harmless tuberculous abscess into an exceedingly harmful mixed infection.

In any case, then, in which it seems impossible to remove all the tuberculous infection and change a tuberculous abscess into a clean wound, it seems important to follow a method which removes the tuberculous pus from the body without substituting for it a worse condition. This can be accomplished by lifting up a fold of the adjoining healthy skin for a distance of three to five centimeters and piercing the abscess with a trocar two or three millimeters in diameter, permitting the tuberculous pus to escape, and then injecting the cavity with a ten per cent. solution of iodoform in glycerine, sterilized. The iodoform should be placed in an open bottle with a cotton stopper, and placed in a water bath. The water should be permitted to boil around the bottle for one hour. This will liberate enough free iodine to accomplish the sterilization.

IODOFORM-GLYCERINE INJECTION OF TUBERCULOUS JOINTS.

There is a great difference of opinion regarding the value of iodoform-glycerine mixtures injected into the cavity of tuberculous joints. Its advocates show a large number of perfect and permanent recoveries following this form of treatment, while its opponents claim that all of these cases belong to a class which would have healed with the same results in about the same time had they been treated with rest and ordinary hygienic measures. Both the advocates and the opponents of this form of treatment represent some of the ablest and most experienced surgeons, and I am not prepared to decide which faction is right, although my own experience is strongly in favor of the use of this method in connection with the early treatment of tuberculosis in all joints, except the hip. There are, however, several points in the technique which should be vigorously obeyed:

1. The trocar should never be plunged directly into a joint, but always obliquely underneath a fold of skin, so that a valve will be formed when the trocar is withdrawn, which will prevent the infection of the joint cavity with pathogenic micro-organisms.

2. The amount of manipulation should be limited, in order to prevent the opening of lymph spaces through which secondary infection might occur.

3. The amount of pressure employed in injecting the solution should be moderate in order to avoid rupturing the capsule of the joint and forcing the fluid, together with tuberculous contents of the joint, into the tissues surrounding.

4. If the treatment does not result in distinct benefit to the patient after five or six applications from one to two weeks apart, it should be abandoned.

5. The patient's general and hygienic influences must be improved.

6. As much as possible of the fluid contained in the joint should be withdrawn before the injection is made.

7. Except in the shoulder and in the sacro-iliac joints, an Esmarch constrictor should be applied before the joint is tapped,

and left in place until a large dressing has been fitted and held in position by a snug bandage, which will prevent hæmorrhage into the joint.

This last precaution is not generally employed, but I am confident that it is of distinct benefit.

In applying the constrictor for this purpose the same precaution should be taken against injuring the large nerves as in other operations. A large rubber tube or a broad rubber bandage should be used in preference to the narrow rubber band which is usually employed. In case a small rubber tube or a narrow band is used, the extremity should be protected by wrapping with a towel, folded upon itself at least four times.

In inserting the trocar into the various joints, aside from carefully securing a valve formation of the canal, the surgeon must avoid injuring important anatomic structures in the vicinity of the joint, and the point of the trocar must be directed so that it will not injure any joint surface.

In the smaller joints a very small amount of the solution may suffice, the quantity employed depending upon the tension caused by the fluid injected, which should never be sufficiently great to endanger the capsule or to produce severe pain. In the wrist joint the introduction of the fine trocar used is usually not followed by the evacuation of any fluid, and here the injection of two to four cubic centimeters will often be followed by perfect results.

In the knee joint it is often possible to withdraw several ounces of fluid, and in these cases it is safe to inject as high as thirty or forty cubic centimeters of the iodoform-glycerine solution.

In the treatment of psoas and iliac abscesses much larger quantities of tuberculous pus are frequently withdrawn through the trocar, and in these cases it is safe to inject from thirty to fifty cubic centimeters of a ten per cent. solution of iodoform in glycerine.

In order to prevent too great tension in injecting this solution into tuberculous joints, it is well to attach a soft rubber tube to the trocar with one end, and to a glass syringe holding thirty cubic centimeters with the other, and then to pour the solution into the glass syringe and to introduce the plunger after the rubber tube and the trocar have become filled with the solution spontaneously.

In forcing in the plunger, if the pressure becomes too great, the intervening rubber tube will become dilated before a sufficient amount of pressure has been exerted to injure the capsule of the joint. In injecting the large joints a large trocar is used, but in the smaller joints the trocar should be just large enough to permit the transmission of the iodoform.

After-Treatment.—Until the pain has subsided the patient should be kept at rest, then a moderate amount of exercise is useful. The injection is repeated every one to two weeks at first, and less frequently later.

THE TREATMENT OF CRUSHING INJURIES OF THE EXTREMITIES.

In the treatment of crushing injuries and lacerated wounds of the extremities, the point of first importance lies in securing, as nearly as possible, aseptic conditions.

It is interesting to observe that there is a marked difference in the difficulty one experiences in obtaining this result in different classes of patients. For persons who are strong and healthy, who live in hygienic surroundings and are cleanly in their habits, it is relatively easy to secure an aseptic wound after one of these injuries. This is ordinarily the condition of railroad employes, skilled mechanics in factories, men employed in the iron mines in the northern part of this country, and in farmers; but not that of the shiftless people who are injured in the streets. Persons who have been employed about horses are more likely to suffer from tetanus than others. This is also true of those who have been injured upon the highways which have been frequented by horses.

The fact that mechanics are likely to have their hands covered with oil and particles of iron and other metal does not indicate that it will be difficult to secure aseptic conditions, because this form of dirt is usually very clean from a surgical standpoint. The oil contained in this dirt has in itself an inhibitory effect upon the development of micro-organisms.

If the injury be severe, it is usually best to anæsthetize the patient, because this will enable the surgeon to be more thorough in cleansing the wound. If it is necessary to transport the patient some distance to his home or to a hospital before it is possible to proceed with the cleansing of the wound, it is best to apply about the extremity a compress of aseptic gauze, wrung out of an antiseptic solution. For this purpose a solution of 1 in 2000 of corrosive sublimate in water is usually most convenient, because it can be prepared wherever it is possible to obtain sterile water, provided the surgeon has with him some tablets of definite size. Any one of a number of other antiseptic solutions may be substituted, such as three per cent. carbolic acid in water, saturated solution of boric acid, or thirty per cent. solution of alcohol. In case water is not available it will suffice to cover the wound with aseptic gauze after the hæmorrhage has been controlled, which is, of course, always the first step necessary.

CONTROL OF HÆMORRHAGE.—If the vessel can be caught with hæmostatic forceps and ligated, such method is most convenient. If this is not possible a suture may be passed around the bleeding point, and the same ligated. If there is simply oozing from a large surface, this may be controlled by pressure, by applying a gauze tampon, to be held in place by a roller bandage.

In some instances, it is best simply to keep the extremity in an elevated position until an elastic constrictor can be applied, and the wound can be disinfected and the vessel ligated.

In case the palmar arch has been injured, and the hæmorrhage cannot be controlled by the application of ligatures or hæmostatic forceps, the arm may be elevated permanently for several days, by applying rubber adhesive straps to the forearm, attaching these to a cross-piece, and this to a cord, which passes over a pulley suspended to the ceiling, or upon a frame to a weight, which will keep the extremity elevated comfortably. An elastic constrictor should never be kept in position for any lengthened period. It is not safe for more than two or three hours at a time, and even this period may give rise to gangrene in some cases, especially if the patient be advanced in age and suffering from endarteritis.

Usually the disinfection can be thoroughly accomplished in less than half an hour.

Disinfection.—If the extremity is covered with black, oily dirt, which is common in mechanics, it is best to wash first with kerosene or some other form of coal oil. Then soap and hot water, with a piece of gauze, should be thoroughly used, then sterile water, then some antiseptic solution, such as 1 to 2000 corrosive sublimate in water, or three per cent. carbolic acid in hot water.

If there is still some doubt, the entire wound may be washed with ninety-five per cent. carbolic acid for one to three minutes and then with strong alcohol until the tissues have a normal appearance.

If the wound has been covered with street dust, or the patient has worked among horses, it seems best to apply strong compound tincture of iodine to the entire surface, and then to rub iodoform over the whole surface, because it is claimed that this treatment will prevent the infection with the tetanus bacillus, and my own observation seems to confirm this theory. There can, however, be no doubt but that the point of greatest importance is the thoroughness with which the wound is scrubbed, so that all particles of dirt will be removed mechanically.

If a hand or a finger, or any other part of an extremity, has been entirely crushed off, the remaining stump may be trimmed up at once, care being taken to sacrifice as little tissue as possible; but in the vast majority of crushing injuries it is much better for the patient if only the complete disinfection is accomplished at once, and the wound left wide open, so that the tissues may have free drainage; this will aid in preventing infection, and will favor the recovery of tissues which seem hopelessly damaged at the time of the injury or first examination. Leaving the wound without suturing until the tissues have recovered, also favor sreturn circulation, because none of the vessels will then be constricted by stitches. Many times a very useful skin flap will become gangrenous because of the venous stasis resulting from the application of sutures directly after an injury has occurred, and before the circulation has become re-established.

For the reasons mentioned, primary amputations after crushing injuries are but rarely indicated.

It would, however, be eminently unsafe to leave these crushed tissues attached to an extremity if the surgeon were careless in his disinfection, but if he is thorough it will result in great benefit to the patient. If, however, the crushed tissue is septic when the patient comes under the surgeon's care, the conditions are entirely changed, because then not only the crushed portion may be lost, but the infection may result in a pyæmia and the patient's life may be endangered. In this case the plan of treatment should be employed which was described in connection with the treatment of septic infections of the extremities. After the infection has subsided, an operation may be performed, which will be indicated by the condition of the tissues. Any necrotic portions will have been removed from time to time while the treatment has caused the septic infection to subside.

If, however, the patient comes under the surgeon's care reasonably early, the danger of a serious infection is very slight, provided the wound is thoroughly disinfected and left wide open, as described above, so that the drainage will be good, and the return circulation is favored by elevating the extremity, and complete rest of the extremity is enforced, so that any unavoidable slight infection will not be pumped through the lymphatics in a proximal direction.

In case any pockets of local infection have been formed, these should be laid wide open, the incision in each case being carried parallel with, and not through, the important anatomical structures in the part involved.

If there are any projecting shreds of tissue which cannot possibly be utilized at any future time, these should be cut away, but no tissue, no matter how irregular, which might be used in a plastic way should be sacrificed until it is known just how much can be saved.

Too much stress has been laid upon the importance of the destruction of large arteries or veins in cases where it seemed wise to amputate at once under the impression that gangrene would certainly occur from the destruction of important vessels. There are many instances in which anomalies have existed, which could not be determined at the time of the injury, or in which there has been an unexpected degree of compensatory circulation, so that an extremity which was theoretically doomed, could be saved entirely, or to a great extent. It should, however, be remembered that one can take these chances only since it is possible to so thoroughly disinfect these wounds that we need not fear a dangerous infection by a waiting, conservative plan of treatment. If we are not competent to secure this condition, then we must abide by the rules laid down at a time when no one was competent in this direction.

In case a joint of considerable size has been opened, the course of treatment to be followed will depend largely upon the judgment of the surgeon. If it seems likely from the conditions present that an infection has taken place, it will be safest to lay the joint widely open, being careful, however, not to increase the infection, and to disinfect it in the same thorough manner as the other tissues. If it seems fairly certain that no infection has taken place, then it will be best to disinfect the wound in the joint as described above, and then to close the latter with a few cat-gut sutures and to leave the remaining wound wide open. Too much importance cannot be given the fact that it is an easy matter to infect an open joint, and that consequently the joint should receive the first attention, and should then be guarded carefully until the remaining portions of the wound have been thoroughly asepticized.

What has been said of the larger joints is true of the metatarsal and phalangeal joints, but it is much less difficult to disinfect these, and consequently there is less danger to the patient.

CRUSHING INJURIES TO BONES.

The large bones have been considered in speaking of compound fractures, and the same principles should be carried out in the treatment of crushing injuries of the smaller bones; fragments which are entirely loose should be removed, and irregular ends should be trimmed with bone-cutting forceps. Rough ends of bones into which dirt has been ground so thoroughly that it cannot be removed should be trimmed in the same manner.

Dressing.—If it is convenient, the following dressing should be employed in wounds of the extremities. A saturated solution of boric acid in hot water, to which one-third, by volume, of strong commercial alcohol has been added, should be used to moisten the aseptic gauze which is applied directly to the wound. In case there is any reason for fearing tetanus infection, a few layers nearest the wound should be composed of iodoform gauze. Over this a thick layer of cotton is applied, and over all a soft roller bandage. If there is an increase in temperature the entire dressing should be surrounded by a rubber sheet, and from a pint to a quart of the same solution should be poured into the dressing every three to six hours. The quantity should be regulated by the size of the dressing, and the rapidity with which the moisture disappears.

If it is not possible to apply a moist dressing the surface should be lightly powdered with iodoform. It should then be covered with iodoform gauze, then with sterile gauze, then with cotton.

The dressings should be applied in such manner that they may be opened without causing unnecessary pain to the patient, so that the wound can be inspected regularly.

If there is a tendency to the occurrence of necrosis the wound should be inspected every day, but if at the first dressing it appears that the nutrition is good, then it will be best to disturb the wound as seldom as possible until it seems to have recovered sufficiently to make the operation for final repair of the injury proper. The condition of the tissues will determine this. If there are small points of necrosed tissue, it is usually best to wait until the circulation in the adjoining structures has been improved to such an extent that no further necrosis need be feared. If the tissues are trimmed too early, one is likely to remove portions which might be utilized to advantage in repairing defects.

In making the final operation, it is far more important that the ultimate result be satisfactory than that the appearance at the conclusion of the operation be pleasing.

Too often a portion of an extremity is sacrificed in order to obtain a handsome stump. The absence of skin from one-half or, in some instances, even three-fourths of the portion of the extremity involved, no longer makes an amputation imperative, because the surface can be covered with skin-grafts, and if this is done before the wound has existed long enough to produce a great amount of cicatricial tissue the extremity frequently becomes very useful. The fact that nerves have been destroyed for a distance not to exceed ten or twelve centimeters does not make an amputation imperative. Neither is this the case if tendons to the same length have been destroyed, because these structures can be grafted and although this is not always successful it so frequently results in a satisfactory functional result that it is quite worth while to make the attempt.

In covering large surfaces with skin grafts, the method which has been described should be carefully followed, because this will result in a substantial, pliable, soft and durable covering, instead of the thin, shiny, adherent skin which one encounters so frequently in cases that have been grafted by different methods.

The old rule of preserving the head of the metatarsal bone invariably, if at all possible, and the head of the metacarpal bone in men who work with their hands, should be borne in mind. It is wise to do this even if there is not sufficient skin to cover the bone. This precaution adds greatly in preserving the usefulness of the hand or foot.

A very small portion of a hand or wrist is valuable to the patient, and every effort should be used to preserve as much as possible of the upper extremity.

In the lower extremity this is also true, unless the ankle joint is involved in the injury and the entire foot is destroyed. In such case an amputation through the lower third of the leg will enable the patient to obtain an artificial limb, with which he can walk comfortably and gracefully.

Above this point it is again necessary to save as much of the extremity as possible.

AMPUTATIONS.

In making amputations, the surgeon should strive to obtain a stump in which the scar is not adherent to the end of the bone, so that subsequently there may not be produced an ulcer at the end of the stump, due to the fact that the fixed scar results in constant pressure upon a given point.

The flaps should be cut so that the scar will be exposed to as little pressure as possible. This is accomplished most readily by making the flaps of different length.

The sharp angles of the ends of bones should be trimmed away for the same purpose.

If the patient be a laborer who is compelled to walk on the soft ground or to lift heavy weights, it is often desirable to obtain for him a stump which will support his body directly upon its end. This can be accomplished only by constructing a covering layer of bone for the end of the stump, effected by making the first section a sufficient distance beyond the point at which the final section is to be made, so that when the second section is made, a plate of the projecting portion can be placed across the sawed end as a covering. The flattest surface of the bone is then chosen, and a thin plate is sawed upward to the point at which the ultimate section is to be made. The periosteal covering of this part is left in place, but the periosteum of the remaining portion of the bone is stripped upward and protected while this portion of the bone is being sawed off transversely.

The attachment of the plate which is left standing will be weakened by a few strokes of the saw, care being taken not to injure the periosteum. The remaining portion is then broken and the plate which has been thus formed is placed across the end of the bone and sutured in position by means of a few stitches of cat-gut passed through the periosteum.

The operation is then completed in the ordinary way.

At the lower end of the femur this method can be accomplished by making a transverse section through the condyles and sawing off the lower surface of the patella.

In the upper extremity, there is, of course, never any occasion for bearing weight upon the end of the stump, hence there is no necessity for any special provision against having the scar opposite the end of the stump.

For this reason the circular method has become popular for amputation of the upper extremity.

It is very important that the flaps be cut long enough to prevent tension. The larger nerves should be found and drawn down and cut off two to five centimeters from the end of the stump in order to prevent their adhesion to the scar. At the end of a nerve of considerable size, it is best to make a V-shaped section, which will permit the two ends to fall together and form a rounded point, which has a tendency to prevent the formation of an amputation neuroma.

The sutures should be drawn only tightly enough to secure coaptation.

Hæmorrhage should be controlled very accurately, so that the flaps will not be separated by blood clots.

In case the wound is not perfectly dry, or if one cannot be absolutely certain that it is aseptic, drainage should be employed. This may be accomplished by the introduction of rubber drainage tubes or by passing through the wound a number of strands of cat-gut or silkworm gut.

The greatest care should be exercised in order to prevent infection, because this favors the formation of pressure neuromata and adherent scars, both conditions being sure to cause great discomfort, if not complete disability, for the patient.

The stump should be dressed with a sufficient amount of gauze and cotton to permit the application of mild, uniform pressure by means of a soft roller bandage.

Rest is one of the most important elements necessary for perfect healing, and this can be most readily obtained by applying a splint in every case in which it is possible. The extremity should be elevated, in order to favor return circulation.

In many of these cases, a much better functional result can be obtained by simply trimming away the portions which cannot be utilized after the circulation in the flaps has recovered sufficiently, and then suturing the remaining portions in the best position possible, and later, by covering the remaining surfaces with skin grafts, than if a complete operation is performed at once. It is often possible to preserve a considerable portion of the extremity which would otherwise have been sacrificed. Many times one or two phalanges of a finger may be saved in this manner, which is a very important matter, especially to a workingman.

SENILE GANGRENE.

Gangrene not directly resulting from severe traumatism or septic infection is most commonly due to a thrombosis of one or more arteries. In aged persons this is usually dependent upon the presence of arterio-sclerosis. Its immediate location is determined by an acute endarteritis which may be the result of a slight traumatism or exposure to cold, not sufficient in either case to affect blood vessels in their normal condition.

The patient feels a severe pain, usually along the course of one of the larger arteries in one of his lower extremities. Upon examination, the part of the extremity beyond the region of the pain is cold to the touch. For a short time after the beginning of the difficulty the skin is white; later it becomes red, still later purple, and then black. Before it becomes black numerous blebs usually form. The area affected is at first not circumscribed, but there is a gradual departure from the normal appearance toward the proximal end of the extremity, which changes into the perfectly black at the distal end. The latter condition may extend over but a small portion of one toe, or it may include one or more of these extremities, or the entire foot, or a large portion of the entire leg.

Usually the morbidity progresses upwards as the thrombus increases in extent. Many times the circulation through the smaller branches of arteries is increased because the communicating branches are dilated, and then the condition will subside and portions which have not yet become black, but which seemed to approach that state, may recover partly or completely. This tendency may be favored by keeping the extremity slightly elevated, to encourage return circulation, and by keeping the temperature as nearly normal as possible by applying artificial heat.

In the meantime the part should be kept covered with an aseptic dressing, which will prevent infection from without. It is well to wash the skin with strong alcohol each day, when a fresh dressing is applied.

Treatment.—For a number of years the opinion has prevailed among surgeons that it is best to make an amputation high up on the extremity early in the attack, in order to prevent the thrombosis from extending upward into the common iliac artery and thence to the same vessel on the opposite side. It seems that this theory cannot be supported by my own experience, and consequently I will advise the plan which has been found most satisfactory in my own practice. It is to be borne in mind, however, that this is an open question as yet, and that the plan here advised should consequently not be accepted as final.

My patients have fared best when I have kept the extremity as aseptic as possible until the line of demarkation had formed. If this occurred at any point at which an amputation would result in a useful stump that point was chosen for the amputation. If a more useful stump could be secured by making the amputation higher up that location was selected.

In making the amputation three requirements were observed:

1. The extremity was elevated in order to make the field of operation bloodless by the aid of gravitation. It was kept in this position throughout the operation, no constrictor of any kind being employed.

2. The flaps were made ample, so that they would cover the end of the stump without the slightest amount of stretching.

3. No sutures were employed for closing the wound, the flaps being simply placed in apposition and a large, rather loose dressing applied to hold the flaps in place.

It will be seen that these precautions are intended to prevent impairment of the circulation, which is already greatly hampered. The extremity is then placed in a slightly elevated position to favor return circulation.

By following these precautions the results have been very satisfactory.

After the circulation has become thoroughly established in the flaps it is safe to apply secondary sutures at any point at which satisfactory union has not taken place, or where the coaptation of the skin has not been effected.

After-Treatment.—In all of these cases it is important that the patient be guarded against exposing himself in the future to the circumstances which acted as exciting causes of difficulty. He should avoid traumatism, cold and infection. His general hygienic conditions should be improved and his diet regulated.

DIABETIC GANGRENE.

In many cases this disease seems to be due to the presence of diabetes.

It has been observed that an operation upon a patient suffering from diabetic gangrene is likely to be followed by death within a very few days, in fact, usually within two days, with the symptoms of diabetic coma. This fact has induced many surgeons to absolutely advise against surgical intervention in cases of gangrene complicated with diabetes. This course will disable the patient for a long period of time, if not permanently, and it exposes him to the danger of an intercurrent septic infection, which is very likely to occur sooner or later, because the tissues in diabetic patients seem especially well suited as culture media for pathogenic micro-organisms.

In a large proportion of these cases it is not necessary to follow this plan, because with proper preparatory treatment, it is possible to improve the condition to such an extent that they will bear amputations almost as well as patients suffering from uncomplicated senile gangrene.

Treatment.—The important features of the treatment consist in giving large quantities of distilled water, from two to six quarts per day, until the thirst has entirely disappeared, which is usually accomplished within two weeks, and after this the quantity of distilled water used is regulated by the patient's desire. A moderate anti-diabetic diet is given—a diet which should be free from sugar, poor in starches, but in which vegetables may be given very freely. The diet should contain considerable fat, especially olive oil, if it is agreeable to the patient. In order to determine the extent of improvement in the patient's condition, it is, of course, necessary to make a quantitative analysis of the urine from time to time.

When the patient's physical state has improved satisfactorily, the amputation should be made precisely as in senile gangrene, but the greatest speed should be exercised and the slightest possible amount of traumatism should be inflicted. There seems to be no small danger from the late effects of anæsthetics in these cases, and consequently the time of anæsthesia should be reduced as much as is compatible with careful surgical work.

After-Treatment.—The same precautions should be employed as after the operation for senile gangrene, but especial attention should be given to the diet of these patients throughout the remainder of their lives.

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